# E. CHUM SALMON

## E.1 BACKGROUND AND HISTORY OF LISTINGS

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Chum salmon (*Oncorhynchus keta)* are semelparous, spawn primarily in freshwater, and apparently exhibit obligatory anadromy, as there are no recorded landlocked or naturalized freshwater populations (Randall et al. 1987). The species is known for the enormous canine-like fangs and striking body color (a calico pattern, with the anterior two thirds of the flank marked by a bold, jagged, reddish line and the posterior third by a jagged black line) of spawning males. Females are less flamboyantly colored and lack the extreme dentition of the males.

The species has the widest natural geographic and spawning distribution of any Pacific salmonid, primarily because its range extends further along the shores of the Arctic Ocean than other salmonids. Chum salmon have been documented to spawn from Korea and the Japanese island of Honshu, east, around the rim of the North Pacific Ocean, to Monterey Bay in California. Presently, major spawning populations are found only as far south as Tillamook Bay on the Northern Oregon coast. The species' range in the Arctic Ocean extends from the Laptev Sea in Russia to the Mackenzie River in Canada. Chum salmon may historically have been the most abundant of all salmonids: Neave (1961) estimated that prior to the 1940s, chum salmon contributed almost 50% of the total biomass of all salmonids in the Pacific Ocean. Chum salmon also grow to be among the largest of Pacific salmon, second only to chinook salmon in adult size, with individual chum salmon reported up to 108.9 cm in length and 20.8 kg in weight (Pacific Fisherman 1928). Average size for the species is around 3.6 to 6.8 kg (Salo 1991).

Chum salmon spend more of their life history in marine waters than other Pacific salmonids. Chum salmon, like pink salmon, usually spawn in coastal areas, and juveniles out migrate to seawater almost immediately after emerging from the gravel that covers their redds (Salo 1991). This ocean-type migratory behavior contrasts with the stream-type behavior of some other species in the genus *Oncorhynchus* (e.g., coastal cutthroat trout, steelhead, coho salmon, and most types of chinook and sockeye salmon), which usually migrate to sea at a larger size, after months or years of freshwater rearing. This means survival and growth in juvenile chum salmon depends less on freshwater conditions than on favorable estuarine conditions. Another behavioral difference between chum salmon and species that rear extensively in freshwater is that chum salmon form schools, presumably to reduce predation (Pitcher 1986), especially if their movements are synchronized to swamp predators (Miller and Brannon 1982).

In December 1997 the first ESA status review of west coast chum salmon (Johnson et al. 1997) was published which identified four ESU: 1) Puget Sound/Strait of Georgia ESU, which includes all chum salmon populations from Puget Sound, the Strait of Georgia, and the Strait of Juan de Fuca up to and including the Elwha River, with the exception of summer-run chum salmon from Hood Canal; 2) Hood Canal summer-run ESU, which includes summer-run populations from Hood Canal and Discovery and Sequim Bays on the Strait of Juan de Fuca; 3) Pacific coast ESU, which includes all natural populations from the Pacific coasts of California,

Oregon, and Washington, west of the Elwha River on the Strait of Juan de Fuca; and 4) Columbia River ESU.

In March 1998, NMFS published a federal register notice describing the four ESUs and proposed a rule to list two--Hood Canal summer-run and Columbia River ESUs--as threatened under the ESA (NMFS 1998). In March 1999, the two ESUs were listed as proposed, with the exception that the Hood Canal summer-run ESU was extended westward to include summer-run fish recently documented in the Dungeness River (NMFS 1999a).

The NMFS convened a BRT to update the status of listed chum salmon ESUs coastwide. The chum salmon BRT[1] met in January, March and April 2003 in Seattle, Washington to review updated information on each of the ESUs under consideration.

[1] The Biological Review Team (BRT) for the updated chum salmon status review included, from the NMFS Northwest Fisheries Science Center: Tom Cooney, Dr. Robert Iwamoto, Dr. Robert Kope, Gene Matthews, Dr. Paul McElhany, Dr. James Myers, Dr. Mary Ruckelshaus, Dr. Thomas Wainwright, Dr. Robin Waples, and Dr. John Williams; from the NMFS Southwest Fisheries Science Center: Dr. Peter Adams, Dr. Eric Bjorkstedt, and Dr. Steve Lindley; from the NMFS Alaska Fisheries Science Center (Auke Bay Laboratory): Alex Wertheimer; and from the USGS Biological Resource Division: Dr. Reginald Reisenbichler.

# E.2.1. HOOD CANAL SUMMER-RUN CHUM SALMON

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## E.2.1.1. Summary of Previous BRT Conclusions

The status of Hood canal summer-run chum salmon was formally assessed during a coastwide status review (Johnson et al. 1997). In November 1998, a BRT was convened to update the status of the ESU by summarizing information received since that review and comments on the 1997 status review, summarize, and present BRT conclusions concerning ESU delineation and risk assessment for chum salmon in Washington, Oregon, and California (NMFS 1999b).

### Status and trends

In 1994, petitioners identified 12 streams in Hood Canal as recently supporting spawning populations of summer-run chum salmon. At the time of the petition, summer-run chum salmon runs in five of these streams may already have been extinct, and those in six of the remaining seven showed strong downward trends. Similarly, summer-run chum salmon in Discovery and Sequim Bays were also at low levels of abundance. Spawner surveys in 1995 and 1996 revealed substantial increases in the number of summer-run chum salmon returning to some streams in Hood Canal and the Strait of Juan de Fuca. However, serious concerns remained (Johnson et al. 1997). First, the population increases in 1995 and 1996 were limited to streams on the western side of Hood Canal, especially the Quilcene River system, while streams on the southern and eastern sides of Hood Canal continued to have few or no returning spawners. Second, a hatchery program initiated in 1992 was at least partially responsible for adult returns to the Quilcene River system. Third, the strong returns to the west side streams were the result of a single, strong year class, while declines in most of these streams have been severe and have spanned two decades. Last, greatly reduced incidental harvest rates in recent years probably contributed to the increased abundance of summer-run chum salmon in this ESU. Spawning escapement to the ESU was estimated to be 10,013 fish in 1997 and 5,290 fish in 1998. Of these totals, 8,734 spawners in 1997 and 3,959 spawners in 1998 returned to streams with supplementation programs.

### Previously reported threats

A variety of threats to the continued existence of the summer-run chum salmon populations in Hood Canal were identified in the status review (Johnson et al. 1997), including degradation of spawning habitat, low river flows, possible competition among hatchery fall chum salmon juveniles and naturally produced summer-run chum salmon juveniles in Hood Canal, and high levels of incidental harvest in salmon fisheries in Hood Canal and the Strait of Juan de Fuca.

### Previous BRT conclusions

The status of the Hood Canal summer-run chum salmon ESU was last reviewed in November 1998, where they concluded that the ESU was likely to become endangered in the

foreseeable future. The primary concerns of the BRT relating to ESU status were low current abundance relative to historical, extirpation of historical populations on the eastern part of Hood Canal, declining trends, and low productivity. Other concerns included the increasing urbanization of the Kitsap Peninsula, recent increases in pinniped populations in Hood Canal, and the fact that recent increases in spawning escapement have been associated primarily with hatchery supplementation programs. Concerns were mitigated to some extent by recent reforms in hatchery practices for fall chum salmon and measures taken by the state and tribes to reduce harvest impacts on summer-run chum salmon.

**Listing status**—Threatened

## E.2.1.2 New Data and Updated Analyses

### ESU status at a glance

| | |
|---|---|
| Historical peak abundance | N/A |
| Historical populations | 16 |
| Extant populations | 8 |
| 1999-2002 geometric mean escapement per extant population | 10 – 4,500 |
| 1999-2002 arithmetic mean escapement per extant population | 52 – 4,700 |
| recent (1990-2002) trend per extant population | 0.82 – 1.62 (median = 1.17) |
| long-term trend per extant population | 0.88 – 1.08 (median = 0.94) |

### ESU structure

The Hood Canal summer-run chum salmon ESU is comprised of 16 historically independent populations, eight of which are presumed to be extant currently (Table E.2.1.1). Most of the extirpated populations occur on the eastern side of Hood Canal, and some of the seven putatively extinct stocks are the focus of extensive supplementation programs underway in the ESU (WDFW and PNPTT 2000 and 2001).

Table E.2.1.1. Historical populations of summer-run chum salmon in the Hood Canal ESU (WDFW and PNPTT 2001).

| Stock | Status |
|---|---|
| Union River | Extant |
| Lilliwaup Creek | Extant |
| Hamma Hamma River | Extant |
| Duckabush River | Extant |
| Dosewallips River | Extant |
| Big/Little Quilcene River | Extant |
| Snow/Salmon Creeks | Extant |
| Jimmycomelately Creek | Extant |
| Dungeness River | Unknown |
| Big Beef Creek | Extinct |
| Anderson Creek | Extinct |
| Dewatto Creek | Extinct |
| Tahuya River | Extinct |
| Skokomish River | Extinct |
| Finch Creek | Extinct |
| Chimacum Creek | Extinct |

The Hood Canal summer-run chum salmon are part of an extensive rebuilding program developed and implemented since 1992 by the state and tribal co-managers (WDFW and PNPTT 2000 and 2001.) The Summer-run Chum Salmon Conservation Initiative involves six supplementation and two reintroduction projects. The largest supplementation program occurs at the Big Quilcene River fish hatchery, and beginning with the 1997 brood year, all fry from the Quilcene facility have been adipose-fin-clipped. Summer-run chum salmon hatchery fish in Salmon Creek have been thermally marked since 1992, and other supplementation programs in Hood Canal recently have instigated thermal mass-marking of otoliths for distinguishing hatchery- from natural-origin spawners. Reintroduction programs have been initiated in Big Beef and Chimacum creeks. Small numbers of marked fish collected in streams (i.e., $\leq$ 3 per stream) over the 1999-2000 season indicate that some straying of summer-run chum salmon from the Big Quilcene River supplementation program is occurring into other Hood Canal streams (WDFW and PNPTT 2001).

The methods for summary statistics reported below are described in the Methods section of this report. We report summary statistics only for the 8 extant populations of summer-run chum salmon in Hood Canal—where information is available, a few additional populations experiencing hatchery reintroductions or natural recolonization are included in some tables for completeness. More detailed information on the sources, data years and nature of the information reported below is summarized for each population in Appendix A.5.2.

## Abundance of natural spawners

Recent 4-year (1999-2002) geometric mean abundance of summer-run chum salmon in Hood Canal streams containing extant populations ranges from 10 to just over 4,500 spawners (median = 576, mean = 1,064) (Table E.2.1.2; Figure E.2.1.1). Estimates for the fraction of hatchery fish in the combined Quilcene and Salmon/Snow populations are as high as 28 - 51%,

indicating that the supplementation program is resulting in spawners in streams (Table E.2.1.2). In addition to the supplementation programs, reintroduction of hatchery fish to previously occupied streams is occurring in Big Beef and Chimacum creeks. Recent geometric mean escapements from those programs are 17 and 198 adults respectively (over 800 adults in a single year returned to each stream), suggesting that hatchery juveniles released several years ago are successfully returning as adults to spawn.

The 8 extant summer-run chum salmon stocks in Hood Canal are spawning in 13 streams that occur primarily on the western side of Hood Canal. The spatial distribution of the summer-run chum salmon populations in Hood Canal is being extended through reintroduction programs in Big Beef and Chimacum creeks, and through an apparent natural re-colonization in the Dewatto River (J. Ames, WDFW, pers. comm.).

Table E.2.1.2. Abundance and estimated fraction of hatchery fish in natural escapements of Hood Canal summer-run chum salmon spawning populations. (Data are from WDFW and PNPTT 2000, 2001, 2003; Puget Sound TRT, unpublished data).

| **Population** | **Current status** | **Recent 4-year geometric mean escapement (min- max) (1999-2002)** | **Recent 4-year arithmetic mean escapement (1999-2002)** | **% hatchery in natural escapement (1995-2001)** |
|---|---|---|---|---|
| Jimmycomelately[4] | Extant | 10 (1-192) | 52 | NA |
| Salmon[1]/Snow | Extant | 1,521 (463-5,921) | 2,441 | 0-69 |
| Combined Quilcene | Extant | 4,512 (3,065-6,067) | 4,665 | 5-51 |
| Lilliwaup[1] | Extant | 13 (1-775) | 202 | NA |
| Hamma Hamma[3] | Extant | 558 (173-2260) | 783 | NA |
| Duckabush | Extant | 382 (92-942) | 507 | NA |
| Dosewallips | Extant | 919 (351-1,627) | 1,057 | NA |
| Union[5] | Extant | 594 (159-1,426) | 769 | NA |
| Chimacum | Extinct, reintroduction | 198 (0-903) | 464 | 100 (>1999) |
| Big Beef[2] | Extinct, reintroduction | 17 (0-826) | 376 | 100 (>1999) |
| Dewatto | Extinct, natural recolonization | 9 (2-32) | 14 | NA |

[1]supplementation program began in 1992; recent low spawner numbers in Lilliwaup due in part to large fraction of return used for broodstock (J. Ames, WDFW, pers. comm.)
[2]reintroduction program began in 1996
[3]supplementation program began in 1997
[4]supplementation program began in 1999; recent low spawner numbers due in part to large fraction of return used for broodstock (J. Ames, WDFW, pers. comm.)
[5]supplementation program began in 2000

## Trends in natural spawners

Long-term trends in abundance for extant naturally spawning populations of summer-run chum salmon in Hood Canal both indicate that only two populations (combined Quilcene and Union rivers) are increasing in abundance over the length of available time series (Table E.2.1.3). The median long-term trend over all populations is 0.94, indicating that most

populations are declining at a rate of 6% per year. The range in long-term trend across the extant populations in Hood Canal is from 0.88 in the Jimmycomelately and Lilliwaup populations to 1.08 in the Union population. The Quilcene population's positive growth rate is almost surely due to the supplementation program that has been active on that stream.

In contrast to long-term trends, most of the naturally spawning populations of Hood Canal summer-run chum salmon exhibit increasing abundance over the short term—7 of 8 extant populations in the ESU have been increasing in abundance from 1990-2002 (Table E.2.1.3). These recent increases in abundance likely are a reflection of the supplementation programs in some streams and possibly recent improvements in ocean conditions. Short-term median population growth rates ($\lambda$) were calculated under two assumptions about the reproductive success of naturally spawning hatchery fish: the reproductive success was 0 (i.e., HO), or the reproductive success was equal to that of wild fish (i.e., H1). Differing assumptions about the reproductive success of hatchery fish only affected calculations of short-term $\lambda$ for 2 populations because of the dearth of information on the fraction of hatchery fish in time series (Table E.2.1.3). The median short-term $\lambda$ (1.18) and short-term trend (1.17) over all populations are very similar. The most impressive short-term increase in natural spawner abundance has occurred in the Quilcene population (trend = 1.62, $\lambda$ = 1.39), where the supplementation program appears to be succeeding in returning natural spawners to the Big and Little Quilcene rivers. The only population with a declining short-term trend and growth rate is the Lilliwaup, where many of the returning spawners have been collected for broodstock in the supplementation program.

Table E.2.1.3. Estimates of long- and short-term trend, short-term median population growth rate ( ), and their 95% confidence intervals for natural spawners in extant Hood Canal summer-run chum salmon populations (data are from the WDFW and PNPTC, unpublished data). Short-term is calculated assuming the reproductive success of hatchery-origin spawners is equivalent to that of wild-origin spawners (in cases where information on hatchery fish is available).

| **Population** | **Data years** | **LT Trend (CI)** | **ST Trend (CI) (1990-2002)** | **ST $\lambda$ ($\pm$ lnSE) (1990-2002)** [1] |
|---|---|---|---|---|
| Combined Quilcene | 1974 - 2002 | 1.05 (0.96-1.16) | 1.62 (1.31-2.01) | 1.39 (0.22) |
| Dosewallips | 1972 - 2002 | 0.96 (0.90-1.04) | 1.25 (0.94-1.63) | 1.17 (0.24) |
| Duckabush | 1968 - 2002 | 0.91 (0.87-0.96) | 1.14 (0.96-1.36) | 1.1 (0.17) |
| Hamma Hamma | 1968 - 2002 | 0.90 (0.86-0.94) | 1.20 (1.04-1.40) | 1.3 (0.19) |
| Jimmycomelately | 1974 - 2002 | 0.88 (0.84-0.93) | 0.82 (0.64-1.03) | 0.85 (0.16) |
| Lilliwaup | 1971 - 2002 | 0.88 (0.83-0.92) | 1.00 (0.74-1.37) | 1.19 (0.44) |
| Salmon/Snow | 1974 - 2002 | 0.99 (0.94-1.03) | 1.24 (1.12-1.37) | 1.23 (0.10) |
| Union | 1974 - 2002 | 1.08 (1.05-1.12) | 1.10 (1.00-1.22) | 1.15 (0.10) |

[1]Estimates of the fraction of hatchery fish are available only for the combined Quilcene and Salmon/Snow populations for the years 1995-2000.

## Updated information on potential threats

The Puget Sound TRT (unpublished data) has estimated annual fishery exploitation rates for each summer-run chum salmon population in the ESU (Table E.2.1.4). Exploitation rates are calculated as the percentage of the total return that is caught in fisheries (i.e., total return = catch

+ broodstock take + escapement). The estimated numbers of adults harvested (i.e., catch) from Washington and Canadian fisheries are supplied by the co-managers (Nick Lampsakis, PNPTT, pers. comm.). Catch data are available for Hood Canal summer-run chum salmon from 1974 to present.

Table E.2.1.4 Average annual exploitation rates on populations of Hood Canal summer-run chum salmon during three time periods within the period 1974 – 2002. (data source: Puget Sound TRT and WDFW and PNPTT co-managers, N. Lampsakis, pers. comm.).

| **Population** | **1974-1978 mean exploitation rate (%)** | **1979-1997 mean exploitation rate (%)** | **1998-2002 mean exploitation rate (%)** |
|---|---|---|---|
| Combined Quilcene | 28 | 64 | 13 |
| Lilliwaup | 55 | 43 | 3 |
| Dosewallips | 15 | 34 | 3 |
| Duckabush | 15 | 34 | 3 |
| Hamma Hamma | 15 | 34 | 3 |
| Jimmycomelately | 8 | 17 | 1 |
| Union | 56 | 43 | 5 |
| Salmon/Snow | 11 | 18 | 1 |
| Mean | 25 | 36 | 4 |
| Median | 15 | 34 | 3 |
| | | | |
| Anderson | 13 | 34 | extinct |
| Big Beef | 15 | 10 | extinct |
| Dewatto | 55 | 37 | extinct |
| Tahuya | 56 | 39 | extinct |
| Mean | 35 | 30 | |
| Median | 35 | 36 | |

Exploitation rates on the eight extant Hood Canal summer-run chum salmon populations averaged 25% (median = 15%; range 8%-56%) in the earliest 5 years of data availability (1974-1978). The annual exploitation rates increased in the 1980s as a result of increased coho fisheries in the area, and they have since dropped to an average of 4% (median = 3%; range 1%-13%) in the most recent 5-year period, 1998-2002 (Table E.2.1.4). The most intensive harvest occurred on Hood Canal summer-run chum salmon during the period 1979-1991, when the total exploitation rate on the aggregate of Hood Canal summer-run stocks reached up to 81% in 1989 (WDFW and most recent run reconstruction from N. Lampsakis, PNPTT). During the high harvest years (1979-1991), exploitation rates on the eight extant individual summer-run chum salmon populations averaged 47% (median = 44%; range 21%–86%).

Estimates of hatchery strays to Hood Canal tributaries have been made only recently, coinciding with the instigation of hatchery programs to supplement summer-run chum salmon spawning on some streams. Releases of hatchery fish in the tributaries began in 1992 for the Big Quilcene and Salmon Rivers, so estimates of returning adult hatchery fish presently are available only for those streams (Table E.2.1.5). The marking of hatchery-origin fish has begun recently

in a number of streams (fin clips began in Quilcene in 1997, otolith marks: 1992 in Salmon Creek, 1997 in Lilliwaup, Hamma Hamma; 1998 in Big Beef Creek; 1999 in Chimacum and Jimmycomelately creeks; 2000 in Union River). Therefore, distinguishing hatchery-produced from naturally-born summer-run chum salmon will not be possible in most Hood Canal streams until 2001 at the earliest.

Table E.2.1.5. Average estimated annual returns of hatchery summer-run chum salmon to the spawning grounds of extant populations of summer-run chum salmon in Hood Canal (WDFW and PNPTT 2000 & 2001; Puget Sound TRT, unpublished data).

| **Population** | **Year that supplementation program started with broodstock takes** | **Average annual hatchery return to stream (min-max)** [1] | **Hatchery return years** |
|---|---|---|---|
| Combined Quilcene | 1992 | 941 (241 – 1619) | 1995 - 2002 |
| Dosewallips | None | NA | |
| Duckabush | None | NA | |
| Hamma Hamma | 1998 | NA | |
| Jimmycomelately | 1999 | NA | |
| Lilliwaup | 1992 | NA | |
| Salmon/Snow | 1992 | 78 (2 – 319) [2] | 1995 - 2002 |
| Union | 2000 | NA | |

[1] Estimated for Salmon River only.

Information on recent releases of hatchery juvenile summer-run chum salmon into Hood Canal streams is reported in Table E.2.1.6. Average annual juvenile summer-run chum salmon releases in streams receiving hatchery fish ranged from 15,000 – 320,000 (average = 92,000) juveniles per year between 1993 and 2001. The SSHAG group identified all hatchery stocks of Hood Canal summer-run chum salmon as category “1a” or “1b” (Appendix E.5.1).

Table E.2.1.6. Numbers of hatchery-origin juvenile summer-run chum salmon released into Hood Canal streams from 1993-2001. (B. Waknitz, unpublished data)

| Watershed | Dates | Hatchery | Stock | Release Site | Total | Annual Mean |
|---|---|---|---|---|---|---|
| Salmon Creek | 1995-2001 | Salmon Creek | Salmon Creek | SalmonCreek | 366,743 | 52,391 |
| Jimmycomelately Creek | 2000-2001 | Jimmycomelately Creek | Jimmycomelately Creek | Jimmycomelately Creek | 29,780 | 14,890 |
| Chimacum Creek | 1999-2001 | Chimacum Creek | Salmon River | Chimacum Creek | 248,148 | 82,716 |
| Big Quilcene River | 1993-2001 | Quilcene NFH | Big Quilcene River | Big Quilcene River | 2,918,878 | 324,319 |
| Hamma Hamma River | 1998-2001 | Hood Canal | Hamma Hamma | John Creek | 121,000 | 30,250 |
| Lilliwaup Creek | 1995-1997 | Long Live the Kings Lilliwaup | Lilliwaup Creek | Lilliwaup Creek | 93,600 | 31,200 |
| Big Beef Creek | 1997-2001 | Big Beef Creek | Big Quilcene River | Big Beef Creek | 621,332 | 124,266 |
| Union River | 2001 | Hood Canal | Union River | Union River | 75,876 | 75,876 |

Additional potential threats to Hood Canal summer-run chum salmon include negative interactions with hatchery fish (fall chinook, coho, pink, and fall chum salmon) through predation, competition and behavior modification, or disease transfer. The Hood Canal Summer-run Chum Salmon Conservation Initiative reports annually on the predicted risks associated with each of the hatchery species on summer-run chum salmon (WDFW and PNPTT 2000 and 2001). In the original report, the co-managers summarized what they considered to be the most important historical factors for decline for Hood Canal summer-run chum salmon (Table E.2.1.7). Specific mitigation measures have been identified for those hatchery programs deemed to pose a risk to summer-run chum salmon, and most of the mitigation measures had been implemented by 2000. In addition, some programs have been discontinued.

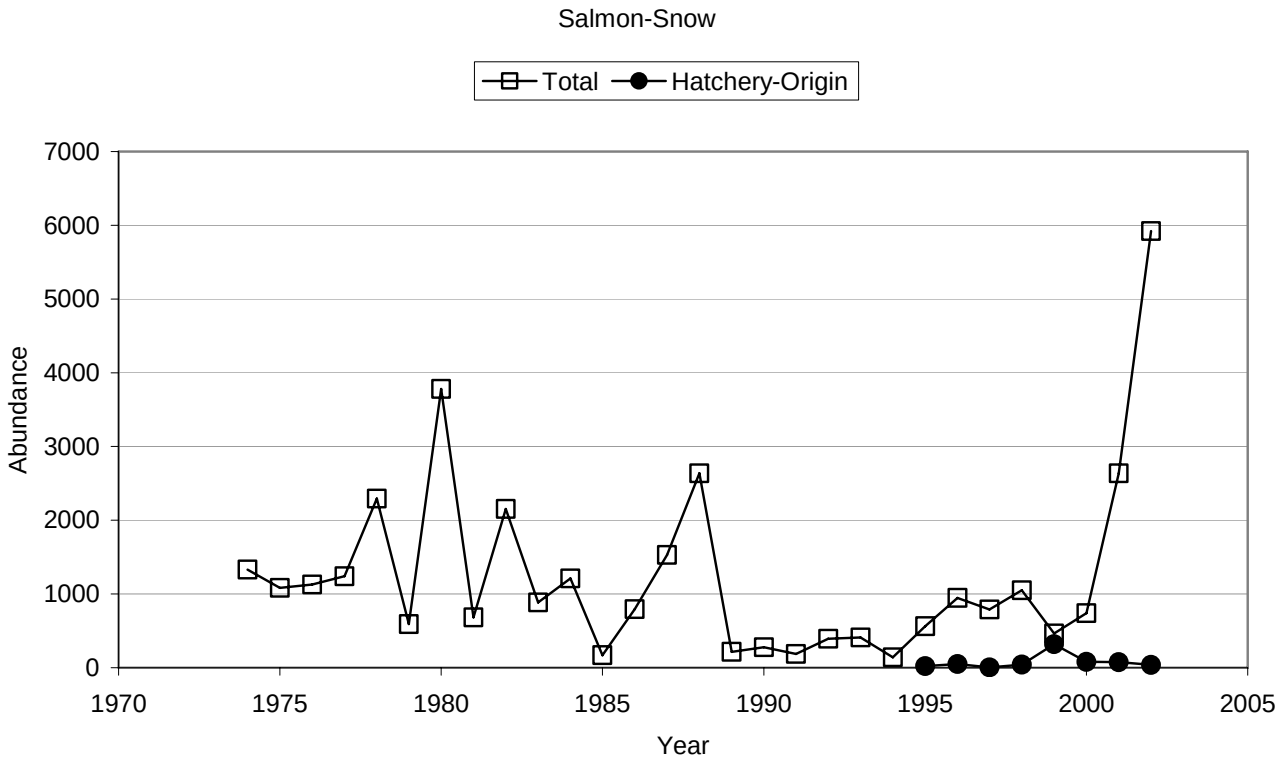
Predation on summer-run chum salmon by marine mammals in Hood Canal has been monitored by WDFW since 1998. The most recent results from these studies estimate that a few harbor seals are killing hundreds of summer-run chum salmon each year (WDFW and PNPTT 2001). Estimates of seal predation ranged from 2% to 29% of the summer-run chum salmon returning to each river annually.

New activities related to mitigating and improving degraded habitat quality in Hood Canal are reported in the Supplemental Report No. 3 under the co-managers' Summer-run Chum salmon Conservation Initiative (WDFW and PNPTT 2001). Such activities include new shoreline management rules issued by Washington Department of Ecology (but no resulting change in shoreline master programs yet), Jefferson County improved some development codes under the Growth Management Act, Clallam County provided limited improvements in upgrading its Critical Areas Ordinance in 1999, and several habitat improvement projects have been funded by the Washington State Salmon Recovery Funding Board. The BRT did not attempt to estimate the collective impacts of these projects on the status of Hood Canal summer-run chum salmon.

Table E.2.1.7. Ratings of region-wide historical factors for decline of summer-run chum salmon in Hood Canal and Strait of Juan de Fuca streams. Impact ratings: +++ Major, ++Moderate, +Low or not likely, and **?** Undetermined (ratings from WDFW and PNPTT 2000).

| **Factor** | | **Hood Canal** | **Strait of Juan de Fuca** |
|---|---|---|---|
| Climate | Ocean conditions | **?** | **?** |
| | Estuarine conditions | **?** | **?** |
| | Freshwater conditions | ++ | +++ |
| Ecological Interactions | Wild fall chum salmon | + | + |
| | Hatchery fall chum salmon | +**?** | + |
| | Other salmonids (including hatchery) | ++ | + |
| | Marine fish | + | + |
| | Birds | + | + |
| | Marine mammals | + | + |
| Habitat | Cumulative impacts | +++ | +++ |
| Harvest | Canadian pre-terminal catch | + | ++ |
| | U.S. pre-terminal catch | + | + |
| | Terminal catch | +++ | + |

Figure E.2.1.1. Hood Canal summer-run chum annual salmon spawner abundance vs. year by population



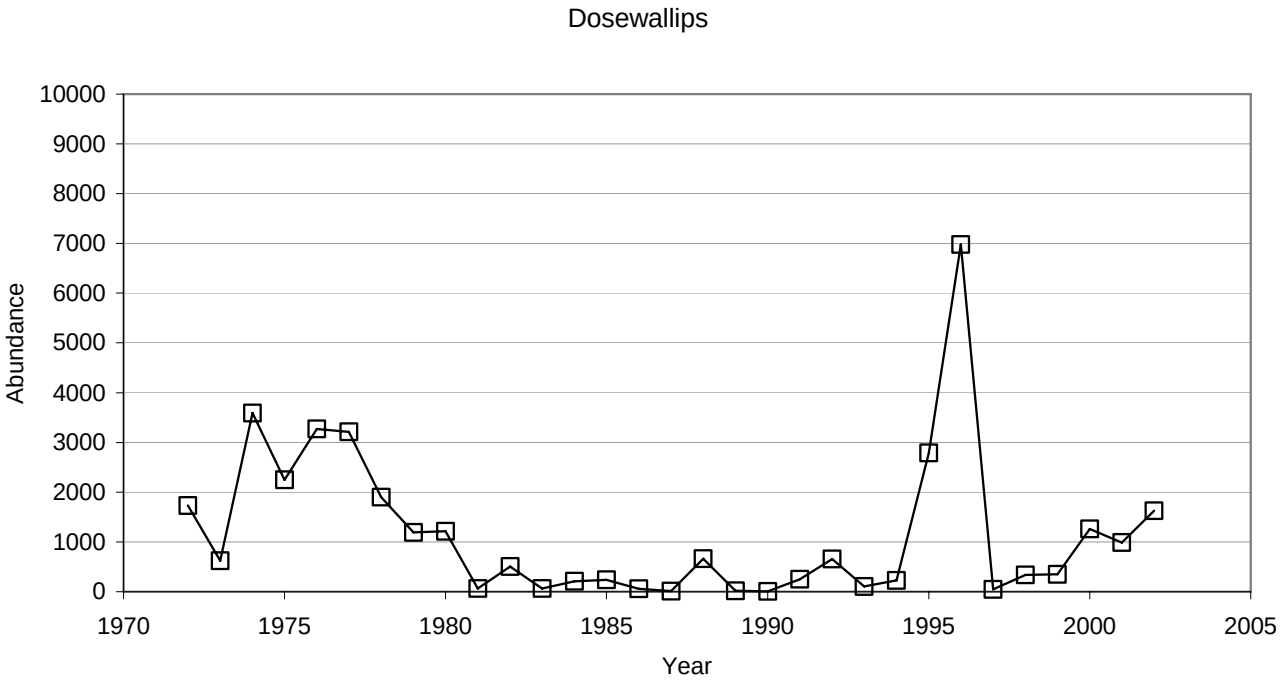
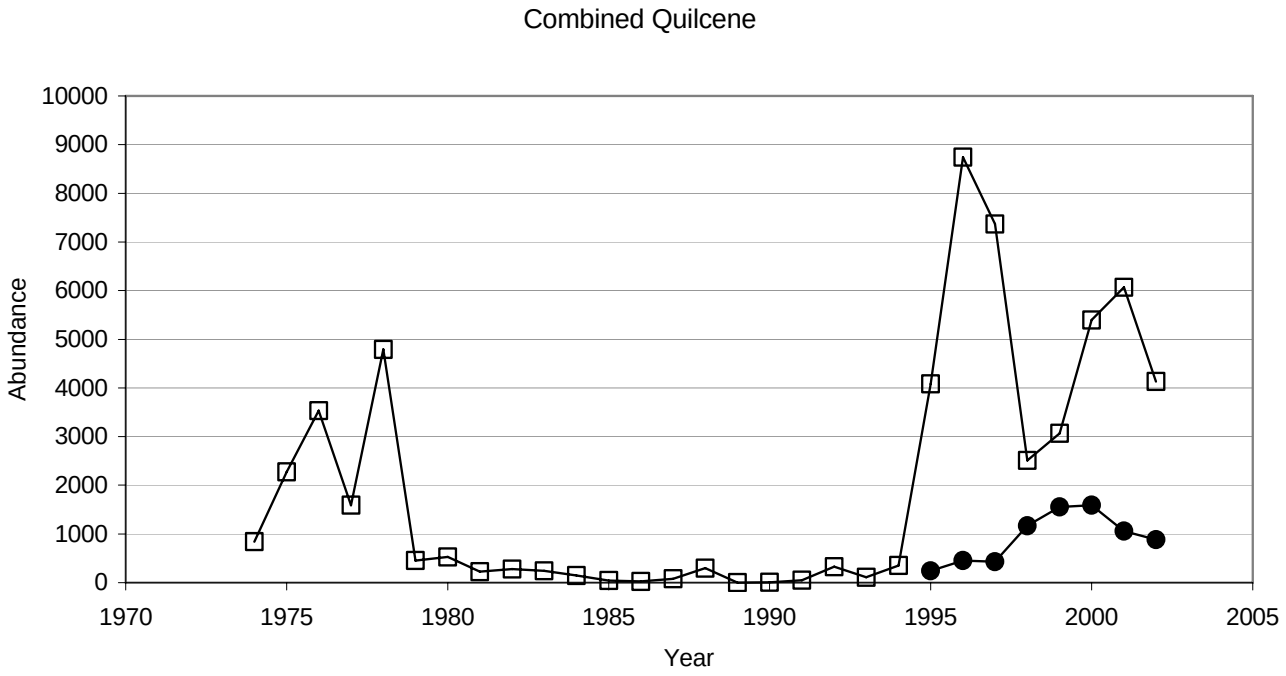
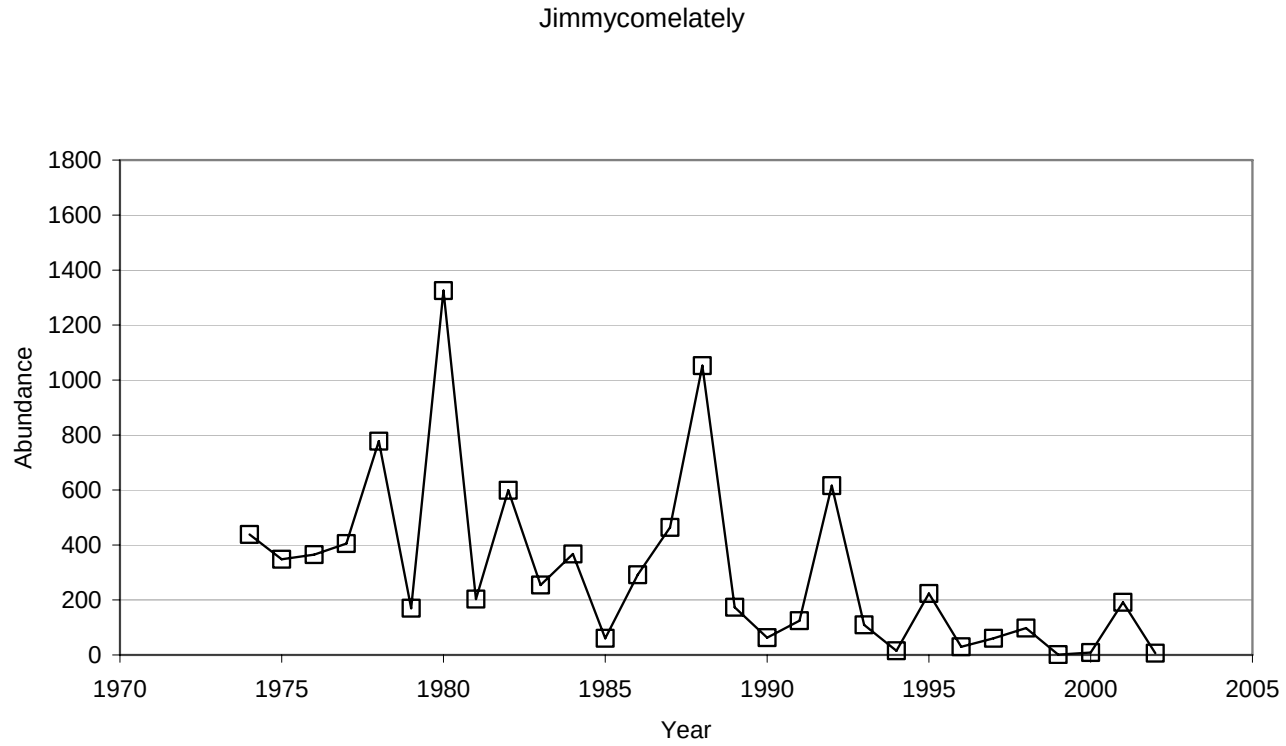



Figure E.2.1.1. (cont.)



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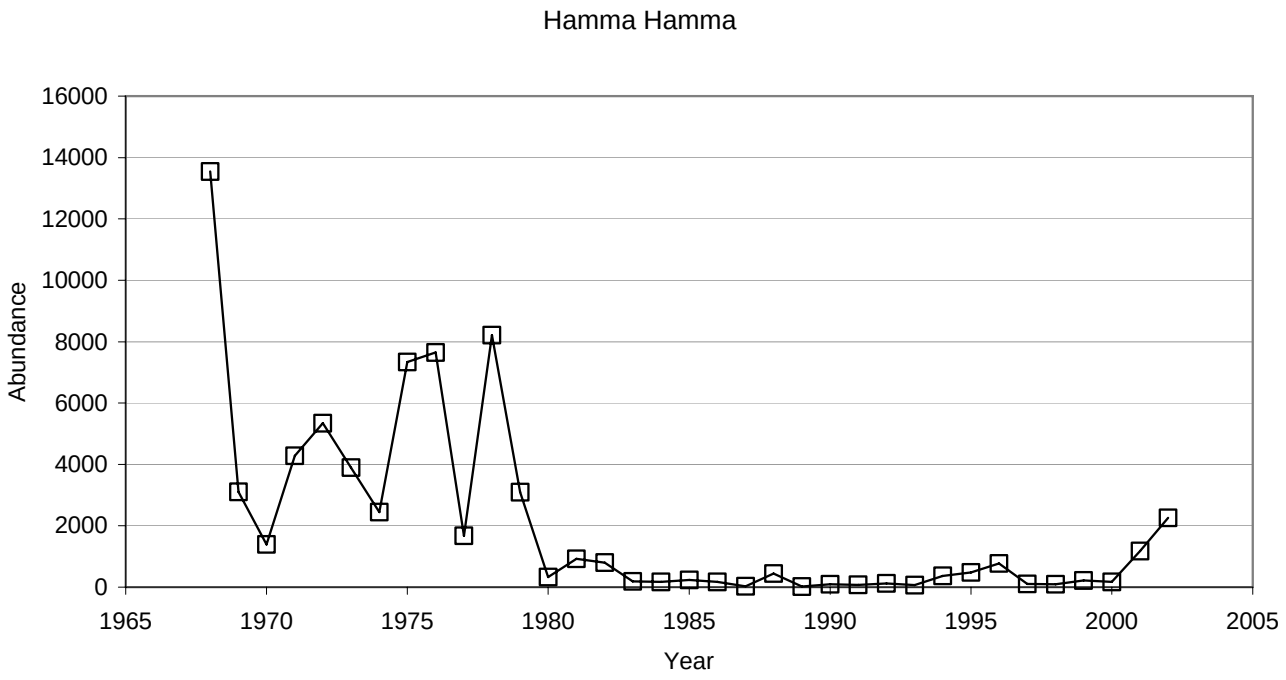


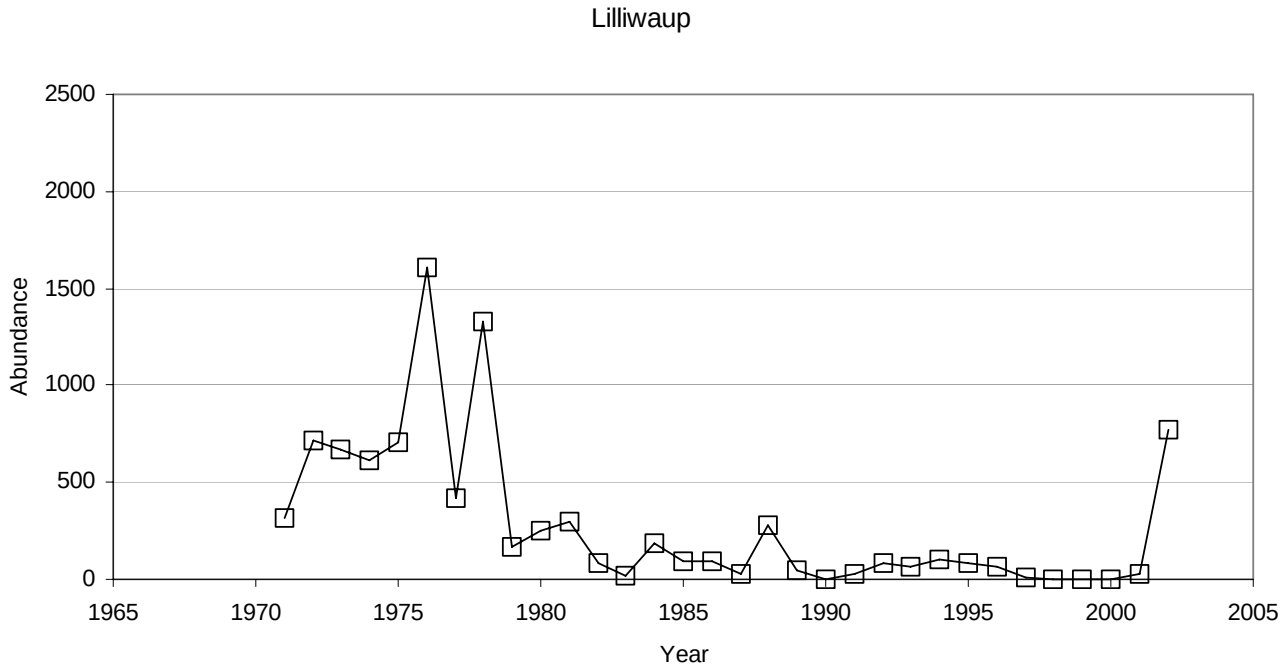

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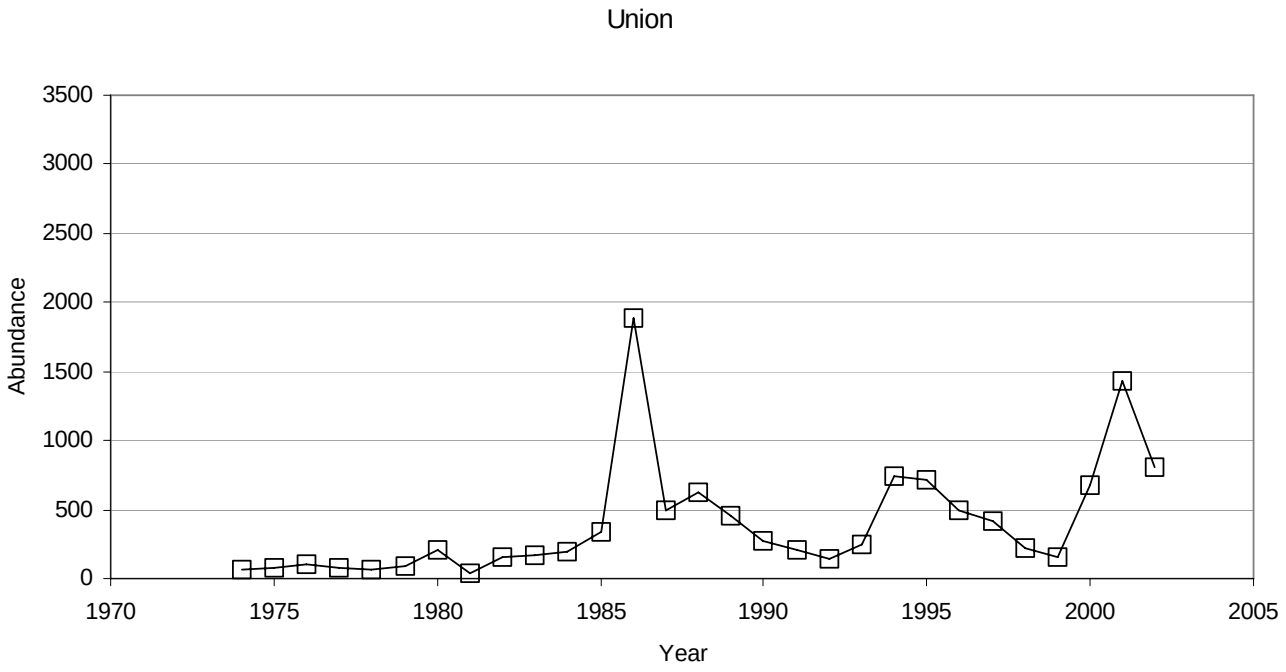
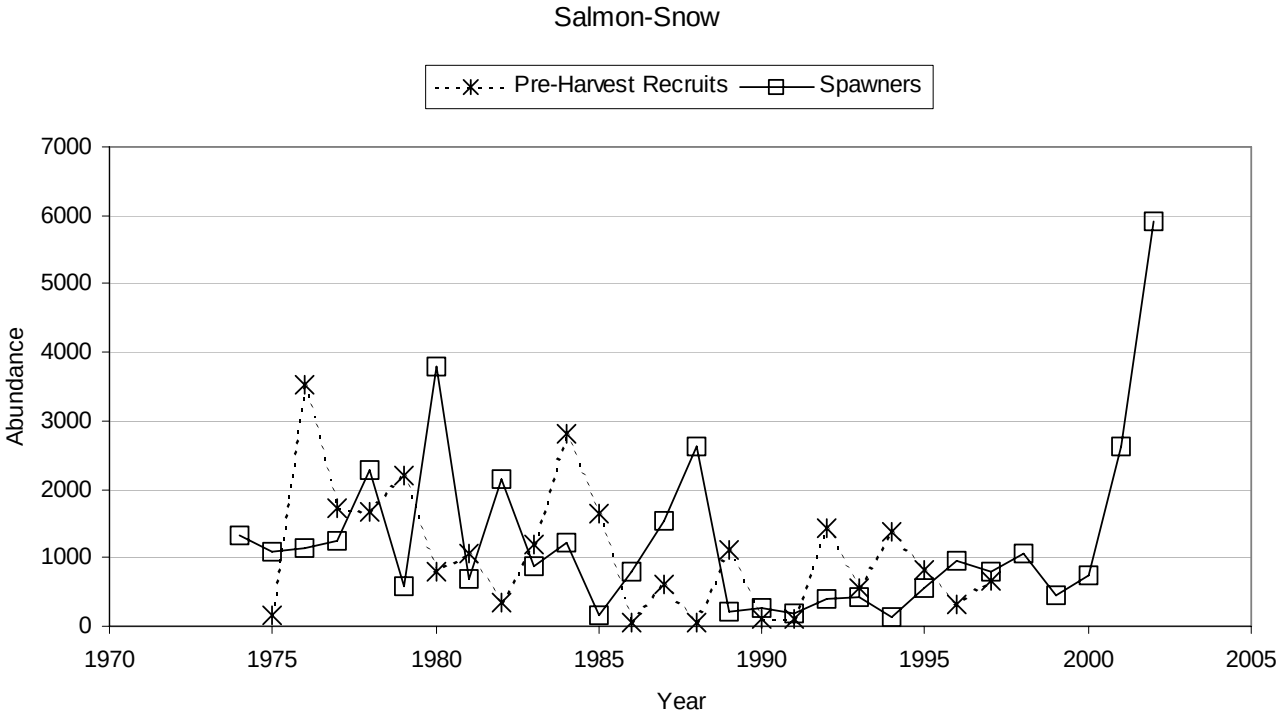


Figure E.2.1.2. Hood Canal summer-run chum recruit and spawner abundance vs. year by population



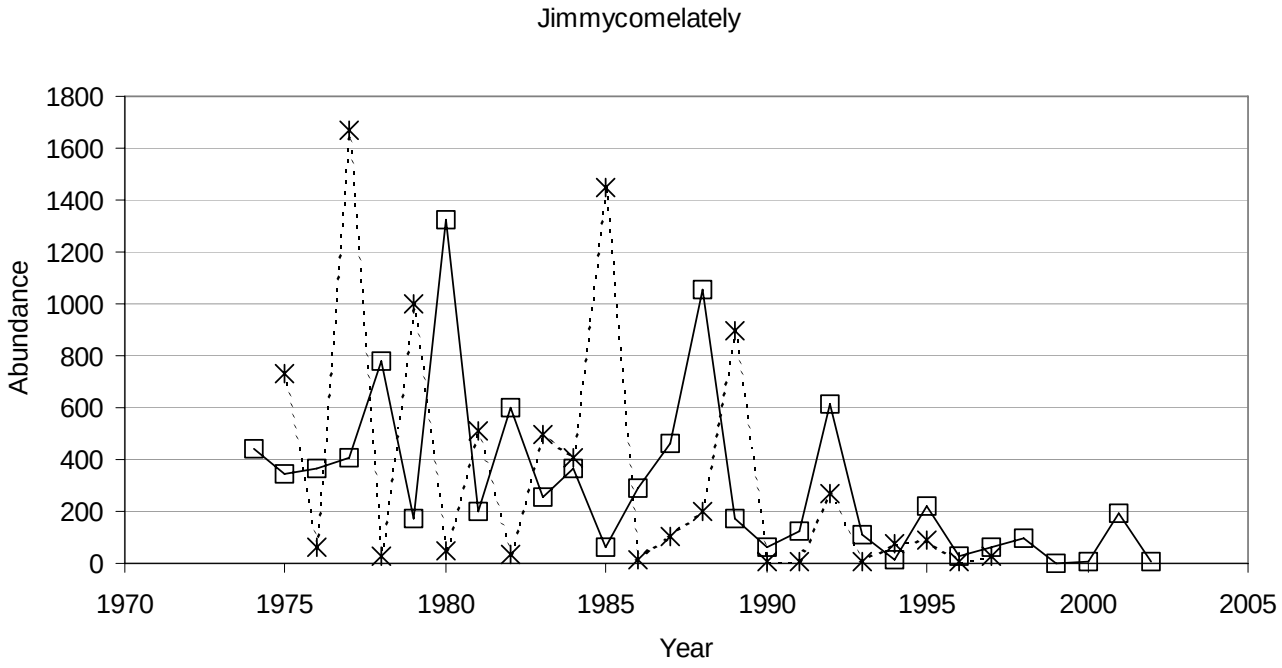
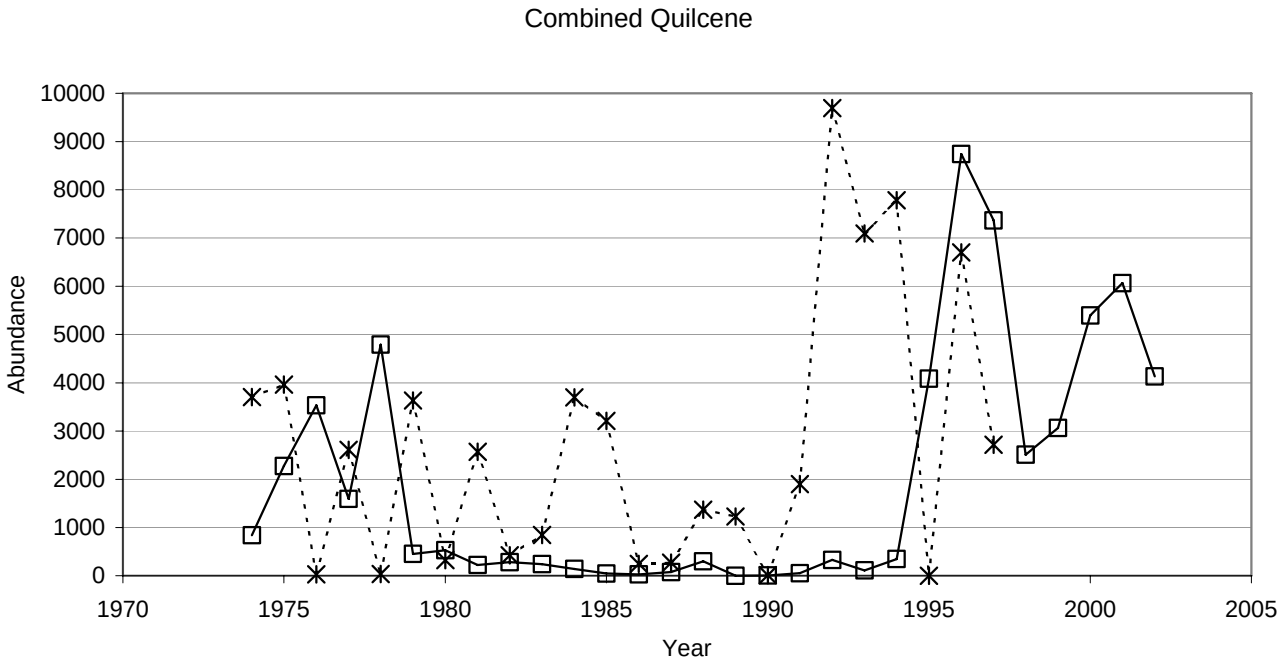
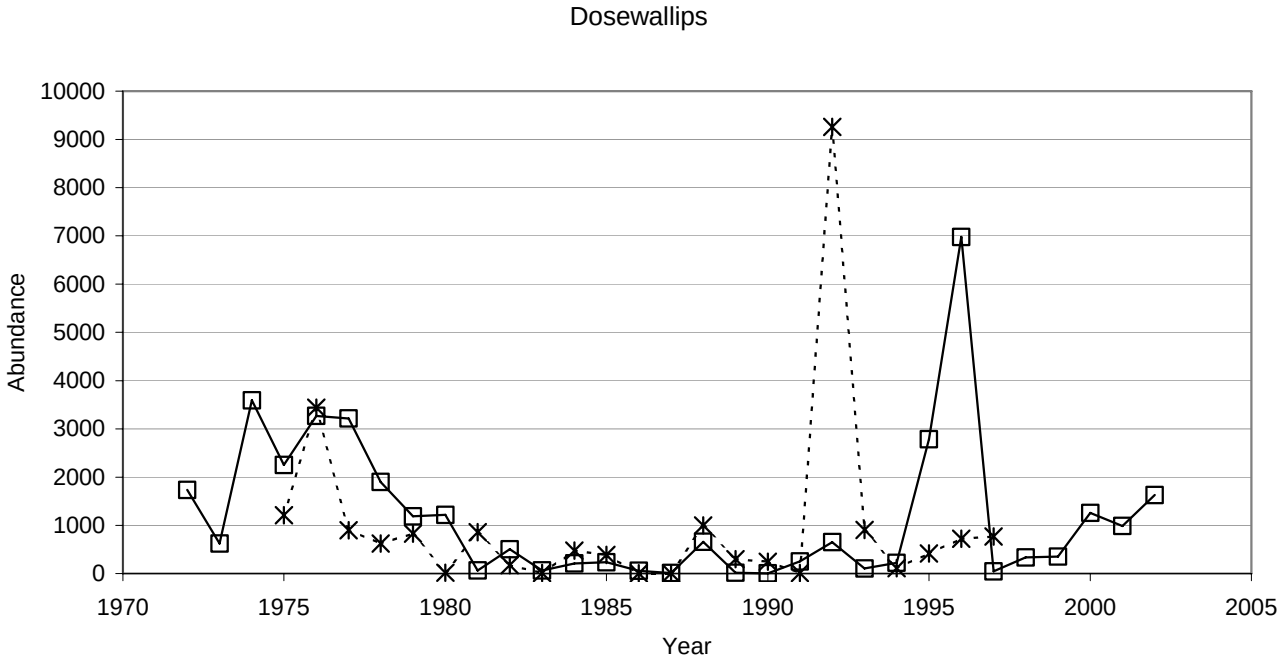



Figure E.2.1.2. (cont.)



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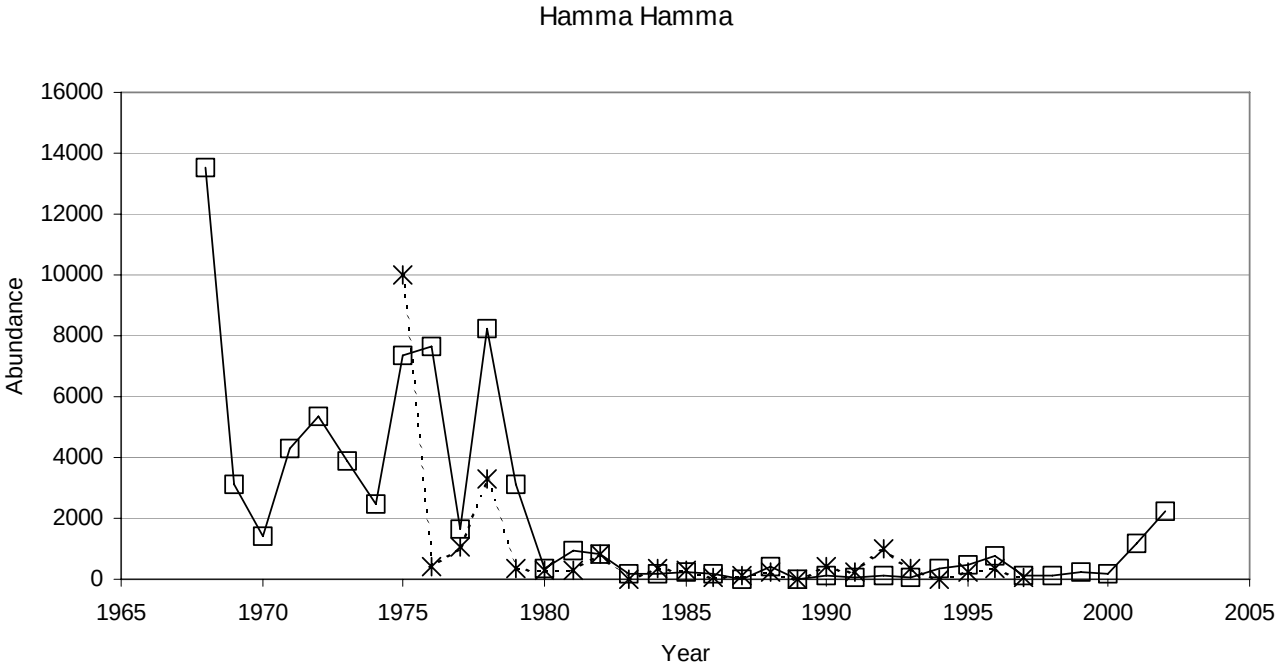


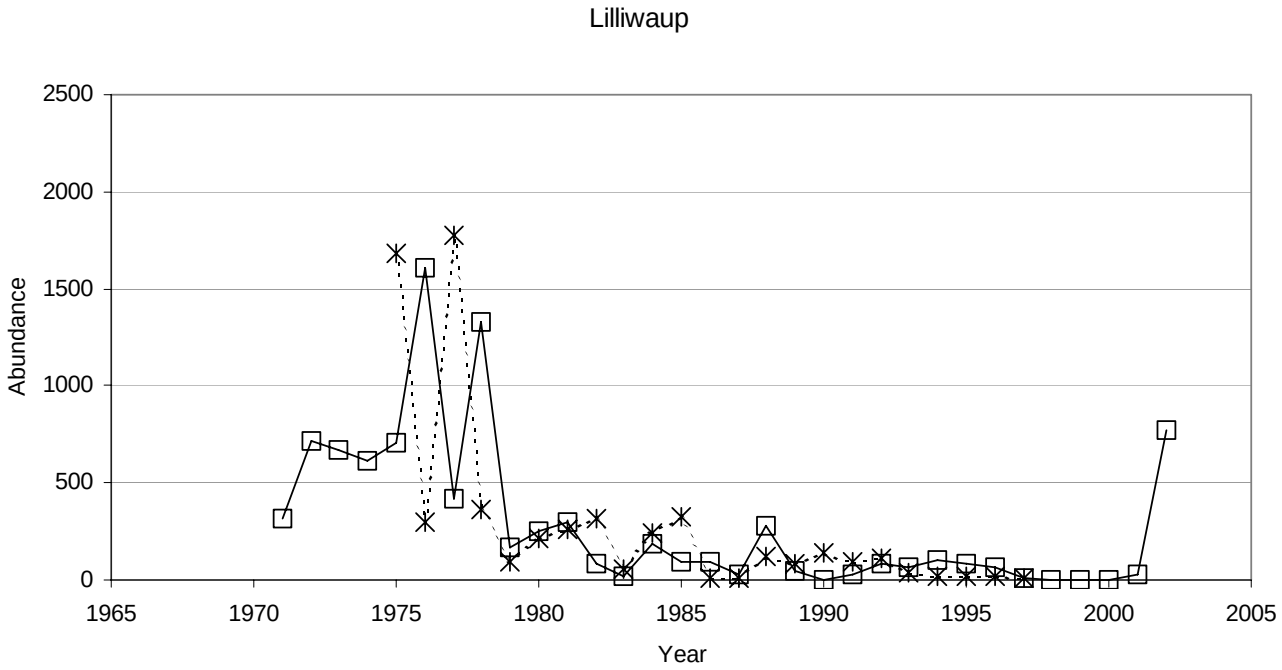

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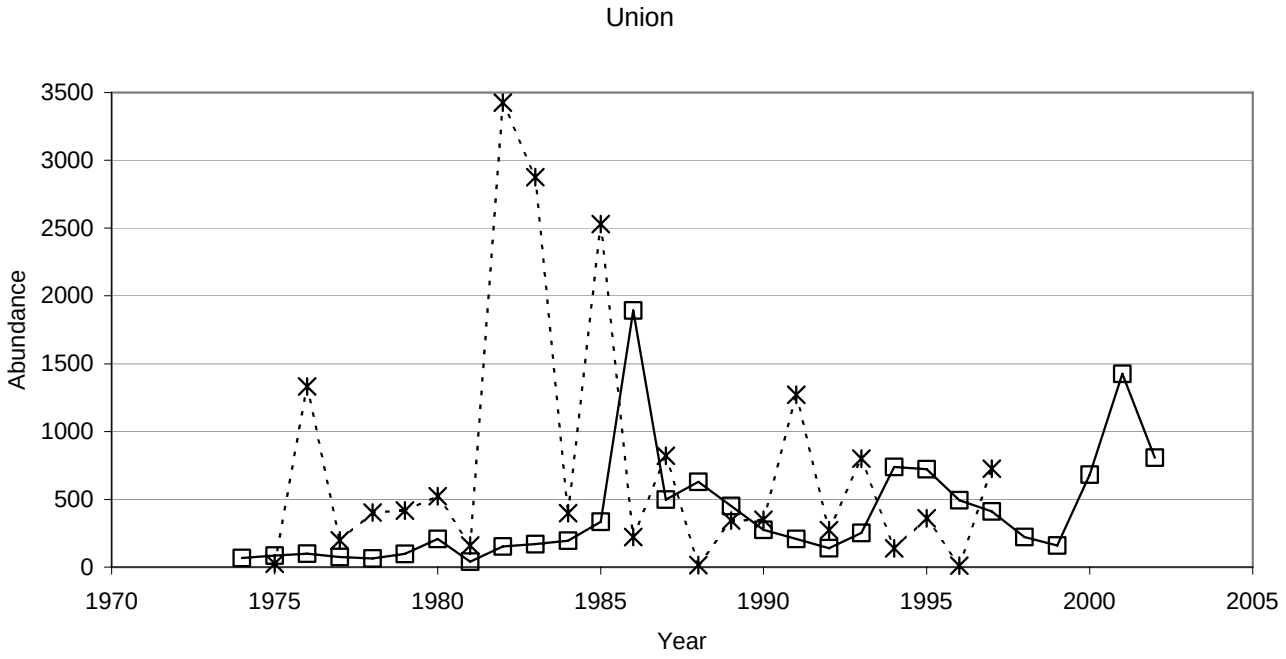

# E.2.2 LOWER COLUMBIA RIVER CHUM SALMON

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## E.2.2.1 Summary of Previous BRT Conclusions

The NMFS last provided an updated status report on Columbia River chum in 1999 (NMFS 1999). As documented in the 1999 report, the previous BRT was concerned about the dramatic declines in abundance and contraction in distribution from historical levels. The previous BRT was also concerned about the low productivity of the extant populations, as evidenced by flat trend lines at low population sizes. A majority of the previous BRT concluded that the Columbia River chum salmon ESU was likely to become endangered in the foreseeable future and a minority concluded that the ESU was currently in danger of extinction.

**Current Listing Status—**Threatened

## E.2.2.2 New Data and Updated Analyses

New data include spawner abundance through 2000, with preliminary estimate of 2002, new information on the hatchery program, and new genetic data describing the current relationship of spawning groups. New analyses include designation of relatively demographically independent populations, recalculation of previous BRT metrics with additional years data, estimates of median annual growth rate ($\lambda$), and estimates of current and historically available kilometers of stream.

### Results of new analyses

**Historical population structure—**As part of its effort to develop viability criteria for Columbia River chum salmon, the Willamette/Lower Columbia Technical Recovery Team (WLC-TRT) has identified historically demographically independent populations (Myers et al. 2002). Population boundaries are based on an application of Viable Salmonid Populations definition (McElhany et al. 2000). Myers et al. (2002) hypothesized that the ESU historically consisted of 16 populations (Figure E.2.2.1). The populations identified in Myers et al. (2002) are used as the units for the new analyses in this report.

The WLC-TRT partitioned Columbia River chum salmon populations into a number of "strata" based on ecological zones (McElhany et al. 2002). The WLC-TRT analysis suggests that a viable ESU would need multiple viable populations in each of these strata. The strata and associated populations for coho are identified in Table E.2.2.1.

Table E.2.2.1. Historical population structure of Columbia River chum populations. The populations are portioned into ecological zones which are based on ecological community and hydro dynamic patterns. The EDT estimate of historical abundance is based on analysis by WDFW of equilibrium abundance under historical habitat conditions (Busack and Rawding 2003). "ND" indicates no data.

| Ecological Zone | Population | EDT Estimate of Historical Abundance |
|---|---|---|
| Coastal | Youngs Bay | ND |
| | Grays River | 7,511 |
| | Big Creek | ND |
| | Elochoman River | ND |
| | Clatskanie River | ND |
| | Mill, Abernathy, Germany | ND |
| | Scappoose Creek | ND |
| Cascade | Cowlitz River | 141,582 |
| | Kalama River | 9,953 |
| | Lewis River | 89,671 |
| | Salmon Creek | ND |
| | Clackamas River | ND |
| | Sandy River | ND |
| | Washougal river | 15,140 |
| Gorge | Lower Gorge Tributaries | >3,141 |
| | Upper Gorge Tributaries | >8,912 |
| | **Total** | **>283,421** |

## Abundance, distribution and trends

Chum salmon in the Columbia River once numbered in the hundreds of thousands of adults and, at times, approached a million per year (Figure E.2.2.2). The total number of chum salmon returning to the Columbia River in the last 50 years has averaged perhaps a few thousand per year, returning to a very restricted subset of the historical range (Table E.2.2.2 and Figures E.2.2.2 – E.2.2.3). The status of individual populations is discussed below. References for abundance time series and related data are in Appendix E.5.2. Significant spawning occurs in only two of the 16 historical populations, meaning that 88% of the historical populations are extirpated, or nearly so. The two extant populations are at Grays River and the Lower Gorge (Figure E.2.2.2). The status of individual populations and groups of populations are discussed below.

**Grays River—**The majority of chum salmon spawning in the Grays River currently occurs in less than 1 mile of the river. Prior to its destruction in a 1998 flood, an artificial spawning channel created by WDFW in 1986, was the location of approximately 50% of the spawning in the Grays River population. Two time series of abundance were available for the Grays River chum salmon population (Table E.2.2.1 and Figures E.2.2.4 -E.2.2.5). One data set by Hymer and others was available on Stream net and covered the years 1944-2000. The other data set covers the years 1967-1998 and was provided by Dan Rawding of WDFW to correct some perceived errors in the expansions used in the Hymer et al. dataset. The Rawding estimates are believed to be more accurate, but both datasets are included in this report because the Hymer et al. series includes estimates both earlier and more recent than the Rawding data set. The Rawding data set shows a small upward trend and λ from 1967-1998 (Table E.2.2.3) and a low probability that the population is declining (Table E.2.2.4). However, the longer Hymer et al. data set indicates both long- and short-term trends are negative over the period 1950-2000, with a high probability that the trend and λ values are less than one. There was insufficient data to estimate the short-term trend (i.e. since 1990) using the Rawding data.

Table E.2.2.2. Recent abundance estimates for subset of Columbia River chum populations. Two different time series estimates are available for the Grays River Population. The majority of Columbia River chum currently spawn as part of either the Grays River or Lower Gorge Populations.

| Population | | Years for Recent Means | Recent Geometric Mean | Recent Arithmetic Mean |
|---|---|---|---|---|
| Grays River | Rawding estimate | 1994-1998 | 704 | 812 |
| | Hymer et al. estimate | 1996-2000 | 331 | 576 |
| Lower Gorge | | 1996-2000 | 425 | 490 |

Table E.2.2.3. Trend and growth rate for subset of Columbia chum populations (95% C.I. are in parentheses). The long-term analysis used the entire data set (see Table C.2.4.2 for years). Short-term data sets include data from 1990 to the most recent available year. The λ calculation is an estimate of what the natural growth rate would have been after accounting for hatchery-origin spawners. Two different time series estimates are available for the Grays River Population.

| Population | | Years of Time Series | Long-Term | | Short-Term | |
|---|---|---|---|---|---|---|
| | | | Trend in Abundance | Median Growth Rate (λ) | Trend in Abundance | Median Growth Rate (λ) |
| Grays River | Rawding estimate | 1967-1998 | 1.058 (1.021-1.096) | 1.043 (0.957-1.137) | Not enough data | Not enough data |
| | Hymer et al estimate | 1951-2000 | 0.990 (0.965-1.016) | 0.954 (0.855-1.064) | 0.904 (0.661-1.235) | 0.807 (0.723-0.900) |
| Lower Gorge | | 1950-2000 | 0.979 (0.961-0.997) | 0.984 (0.883-1.096) | 1.003 (0.882-1.141) | 1.001 (0.899-1.116) |

Table E.2.2.4. Probability that the abundance trend or growth rate of Columbia River chum salmon is less than one. The λ calculation is an estimate of what the natural growth rate would have been after accounting for hatchery-origin spawners. Two different time series estimates are available for the Grays River Population.

| Population | | Years of Time Series | Long-Term | | Short-Term | |
|---|---|---|---|---|---|---|
| | | | Prob. Trend <1 | Prob. λ < 1 | Prob. Trend <1 | Prob. λ < 1 |
| Grays River | Rawding estimate | 1967-1998 | 0.001 | 0.197 | Not enough data | Not enough data |
| | Hymer et al. estimate | 1951-2000 | 0.776 | 0.774 | 0.759 | 0.934 |
| Lower Gorge | | 1950-2000 | 0.987 | 0.657 | 0.478 | 0.494 |

Final abundance estimates for 2002 are also not available, but preliminary estimates have been received (Rawding, pers. comm.). The preliminary estimates suggest a substantial increase in abundance in 2002 over what has been observed over the last 50 years. Survey crews handled over 7,000 chum salmon carcasses in the Grays River in 2002, but the total population size is in the neighborhood of 10,000 adults (Figure E.2.2.4). However, a new chum salmon hatchery program in the Grays River started in 1999 confounds the abundance estimates as hatchery returns are included in the 10,000 adult estimate. The hatchery fish were otolith marked, so it will be possible to determine the fraction of hatchery-origin spawners once the otoliths are read, but that information is not available at this time. The Chinook River is a sub-population of the Grays River population that had essentially no chum salmon in recent years, prior to 2002 return of hatchery fish. In 2002, a preliminary estimate of 600 chum salmon returned to the Chinook River, suggesting a 1% return of 3-year-olds from the hatchery fish. Potential causes of this increase in 2002 are discussed below. No estimates of 2001 abundance were available from WDFW at the time of this report, though run was described as "…large, though not as large as 2002."

**Lower Gorge Population—**The Lower Gorge population consists of a number of subpopulations immediately below Bonneville dam. The subpopulations include Hardy Creek, Hamilton Creek, Ives Island, and the Multnomah area. Both the Ives Island and Multnomah area sub-populations spawn in the Columbia mainstem. The time series used for analysis of the Lower Gorge population is based on summing the abundance in the Hardy Creek, Hamilton Creek, and the artificial spawning channel in Hamilton Creek (Tables E.2.2.1- E.2.2.3, Figures E.2.2.6- E.2.2.7). There is some question about whether or not these data provided a representative index of the population, as it does not include the mainstem spawning areas. Chum salmon may alternate between the tributaries and the mainstem, depending on flow conditions, causing counts in only a subset of the population to be poor indicators of the total population abundance in any given year. Base on these data, the population has shown a downward trend since the 1950s and has been at relatively low abundance up to 2000. However, preliminary data indicate that the 2002 abundance has shown a substantial increase estimated at greater than 2,000 chum salmon in the Hamilton and Hardy creeks, plus another 8,000 or more in the mainstem. There have been no hatchery releases in the lower gorge population, so hatcheries are not responsible for this increase in 2002 unless there has been long distance straying from

Grays River (>100 km). Potential causes of the 2002 increase are discussed below. No estimates of 2001 abundance were available from WDFW at the time of this report, though run was described as "…large, though not as large as 2002."

**Washougal Population—**Chum salmon were recently observed (within the last 3-4 years) to be spawning in the mainstem Columbia River on the Washington side, near the I-205 bridge (at Woods Landing and Rivershore). These spawners would be considered part of the WLC-TRT's Washougal population, as that is the nearest tributary mouth. It is not clear if this is a recently established population or only recently discovered by WDFW. Genetic analysis indicates that the fish currently spawning in this area are more closely related to fish in the lower gorge area than to fish in Grays River (Marshall 2001). In 2000, WDFW estimated 354 spawners at this location (Figure E.2.2.8). As with the two other Columbia chum salmon spawning populations, preliminary data indicate a dramatic increase in 2002. Preliminary estimates put the 2002 abundance of this population in the range of several thousand spawners.

**Upper Gorge Population—**A large portion of the upper gorge population chum salmon habitat is believed to have been inundated by Bonneville Dam. However, small numbers of chum salmon still pass Bonneville Dam (Figure E.2.2.9). The number of fish passing Bonneville showed some increase in 2002, but not the dramatic increases estimated in the other three populations.

## Other Washington populations

In 2000, the Pacific States Marine Fisheries Commission conducted a study to determine the distribution and abundance of chum salmon in on the Washington side of the Columbia River. The results of that survey are shown in Figure E.2.2.8. Very small numbers of chum salmon were observed in several locations, but with the possible exception of the Washougal River mainstem ("I-205) population (discussed above), none of the populations would be considered close to self-sustaining abundances.

## Oregon populations

Chum salmon spawn on the Oregon side of the lower gorge population (Multnomah area), but appear to be essentially absent from other populations in the Oregon portion of this ESU. In 2000, ODFW conducted surveys with a similar purpose to the WDFW 2000 surveys (i.e., to determine the abundance and distribution of chum salmon in the Columbia). Out of 30 sites surveyed, only one chum salmon was observed. With the exception of the Lower Gorge population, Columbia chum salmon are considered extirpated, or nearly so, in Oregon.

## Reason for 2002 increase in abundance

It is not known why the Columbia chum salmon dramatically increased in abundance in 2002. As of the writing of this draft, the run has just ended and firm abundance estimates are not even available yet. However, several hypotheses have already been floated regarding this increase. These include:

- Improved ocean conditions

- Grays River and Chinook River hatchery program
- Columbia river mainstem flow agreements (the lower gorge population is in the tailrace of Bonneville Dam and subject to hydrosystem induced flow fluctuations)
- Favorable freshwater conditions
- Increased sampling effort (Since the 2000 survey, effort seems to have increased, though this alone certainly does not explain the apparent increase).

These are all possible contributors to the increase, but the reason for the increase is not known, just as it is not known exactly why chum salmon were restricted to low abundance and limited distribution for the last 50 year. It does not appear that chum salmon have expanded their range in 2002 beyond the Grays River, Lower Gorge, and I-205 areas, though not all the data on the 2002 survey has been reported. Since the cause of the 2002 increase is unknown, it is impossible to know if it will continue. The 2002 increase in Columbia River chum parallels a recent increase in Puget Sound chum. It is not known if the reasons for the increase in the two regions are the same.

## EDT-based estimates of historical abundance

The Washington Department of Fish and Wildlife (WDFW) has conducted analyses of Columbia River chum salmon populations using the Ecosystem Diagnosis and Treatment (EDT) model, which attempts to predict fish population performance based on input information about reach-specific habitat attributes (http://www.olympus.net/community/dungenesswc/EDT-primer.pdf). WDFW populated this model with estimates of historical habitat condition, which produced the estimates of average historical abundance shown in Table E.2.2.1. There is a great deal of unquantified uncertainty in the EDT historical abundance estimates, which should be taken into consideration when interpreting these data. In addition, the habitat scenarios evaluated as "historical" may not reflect historical distributions, since some areas that were historically accessible but currently blocked by large dams are omitted from the analyses and some areas that were historically inaccessible but recently passable because of human intervention are included. The EDT outputs are provided here to give a sense of the historical abundance of populations relative to each other and an estimate of the historical abundance relative to the current abundance.

## Loss of habitat from barriers

An analysis was conducted by Steel and Sheer (2002) to assess the number of stream km historically and currently available to salmon populations in the Lower Columbia River (Table E.2.2.5). Stream km usable by salmon are determined based on simple gradient cut offs and on the presence of impassable barriers. This approach will over estimate the number of usable stream km, as it does not take into consideration habitat quality (other than gradient). This is likely especially true of chum salmon with seem to prefer particular microhabitats for spawning.

Table E.2.2.5. Loss of habitat from barriers. The potential current habitat is the kilometers of stream below all currently impassible barriers between a gradient of 0% and 3.5%. The potential historical habitat is the kilometers of stream below historically impassible barriers between a gradient of 0% and 3.5%. The current to historical habitat ratio is the percent of the historical habitat that is currently available. This table does not consider habitat quality.

| Population | Potential Current Habitat (%) | Potential Historical Habitat (km) | Current to Historical Habitat Ratio |
|---|---|---|---|
| Youngs Bay | 269 | 287 | 94 |
| Grays River (Hymer) | 229 | 230 | 100 |
| Grays River (Rawding) | 229 | 230 | 100 |
| Big Creek | 369 | 407 | 91 |
| Elochoman River | 242 | 242 | 100 |
| Clatskanie River | 160 | 165 | 97 |
| Mill, Abernathy, Germany | 266 | 306 | 87 |
| Scappoose Creek | 888 | 1,048 | 85 |
| Cowlitz River | 114 | 120 | 95 |
| Kalama River | 382 | 579 | 66 |
| Lewis River | 319 | 362 | 88 |
| Salmon Creek | 416 | 471 | 88 |
| Clackamas River | 148 | 194 | 76 |
| Sandy River | 125 | 240 | 52 |
| Washougal river | 81 | 82 | 99 |
| Lower Gorge Tributaries | 55 | 77 | 71 |
| Upper Gorge Tributaries | | | |
| Total | 4,292 | 5,041 | 85 |

## E.2.2.3 New ESU Information

Updated information provided in this report, the information contained in previous LCR status reviews, and preliminary analyses by the WLC-TRT suggest that 14 of the 16 historical populations (88%) are extinct or nearly so. The two extant populations have been at low abundance for the last 50 years in the range where stochastic processes could lead to extinction. Encouragingly, there has been a substantial increase in the abundance of these two populations. In addition there are the new (or newly discovered) Washougal River mainstem spawning groups. However, it is not known if the increase will continue and the abundance is still substantially below the historical levels.

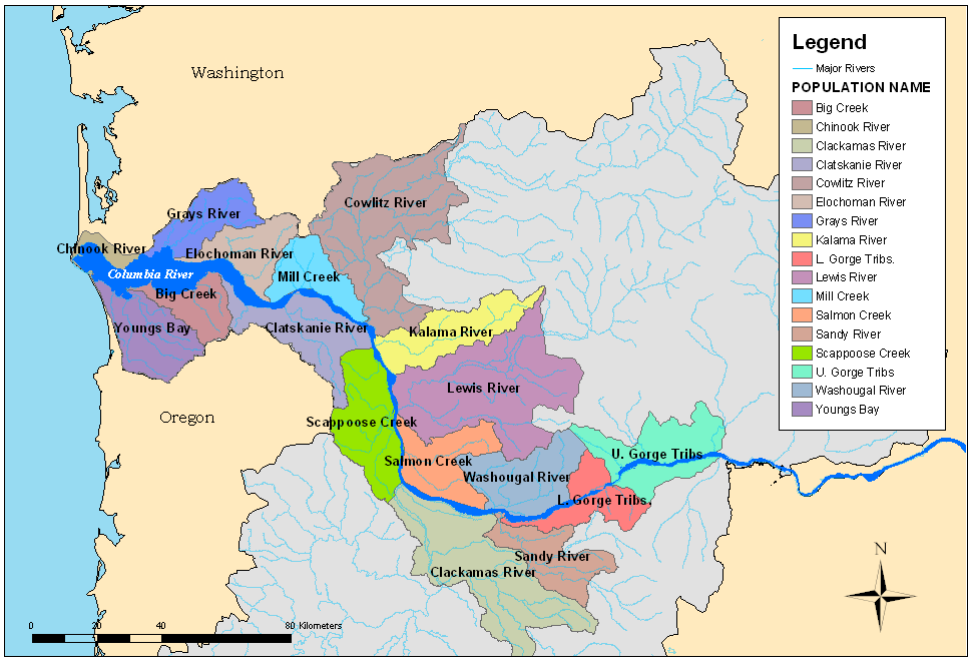


Figure E.2.2.1. Historical chum salmon populations in the Columbia River chum salmon ESU. This map does not reflect the most recent modification of the population designation which merged the Grays River and Chinook River chum salmon into a single population for a total of 16 populations (Myers et al. 2002).

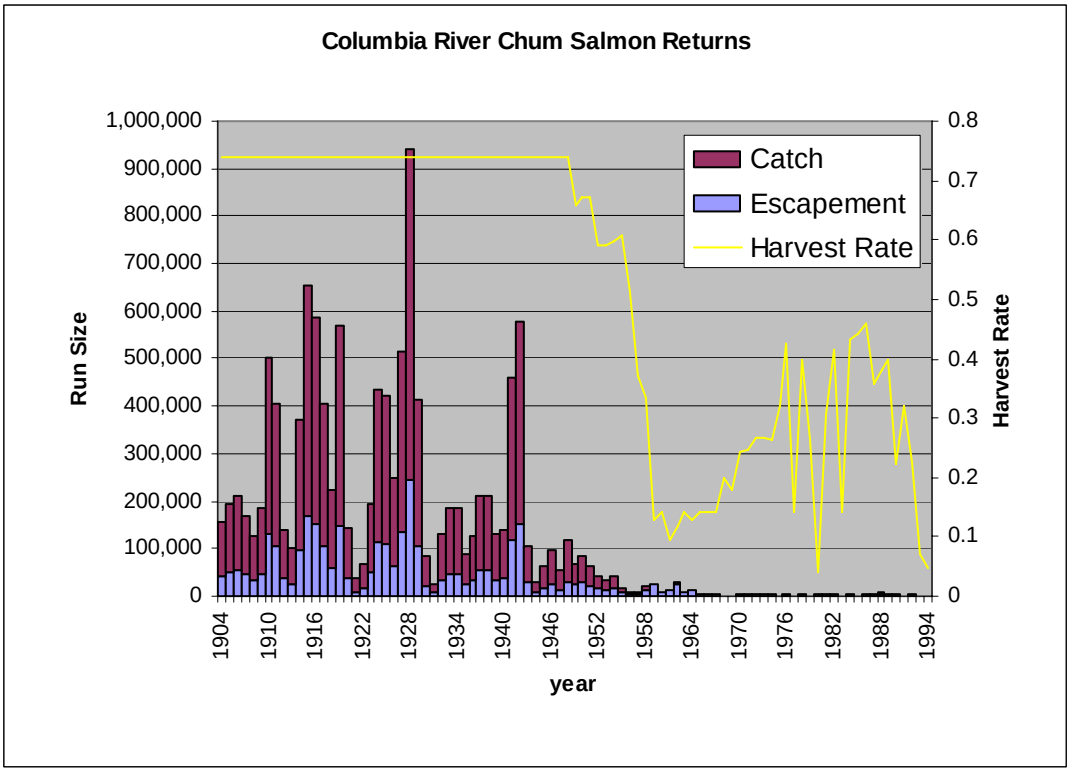


Figure E.2.2.2. Columbia River chum salmon returns.

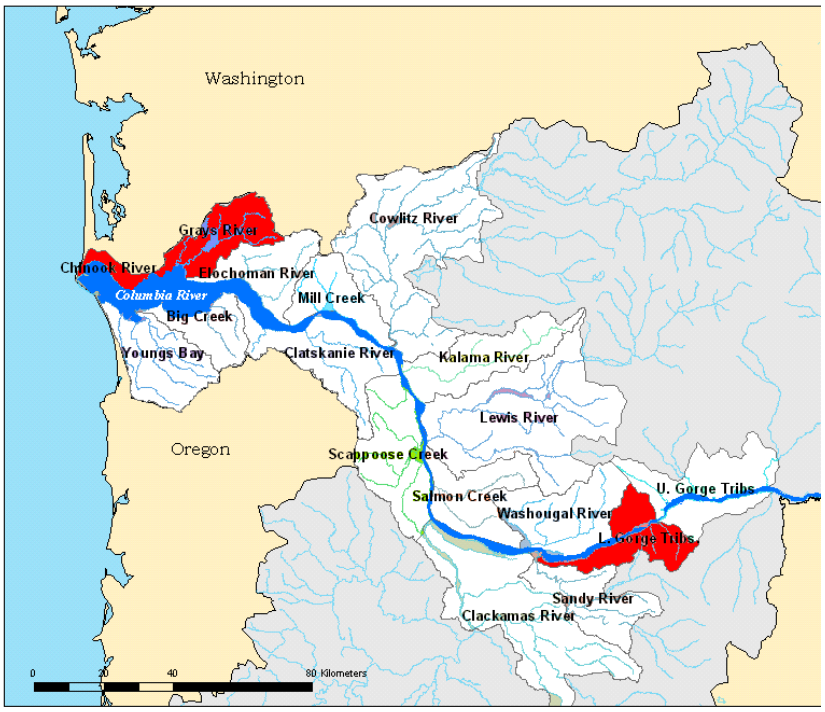


Figure E.2.2.3. Extant Columbia River chum salmon populations.

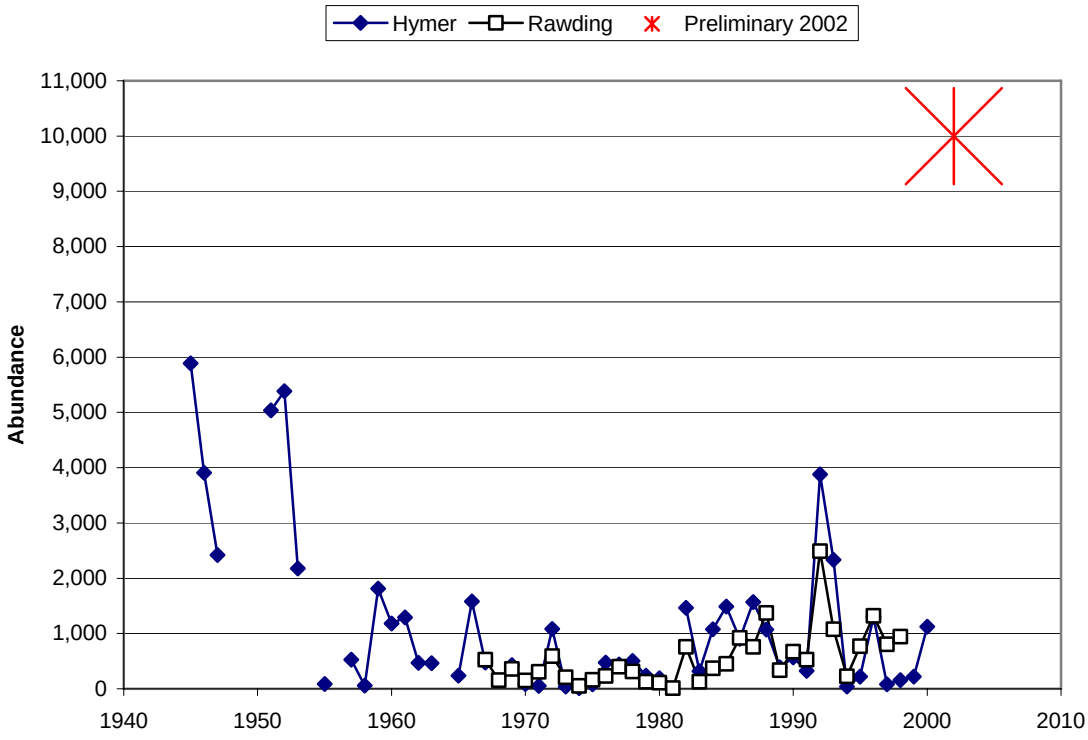


Figure E.2.2.4. Gray's River chum salmon abundance estimate. The two data sets use different information and expansions to estimate the Grays River chum salmon abundance. The 2002 data are preliminary and include an unknown number of hatchery-origin spawners.

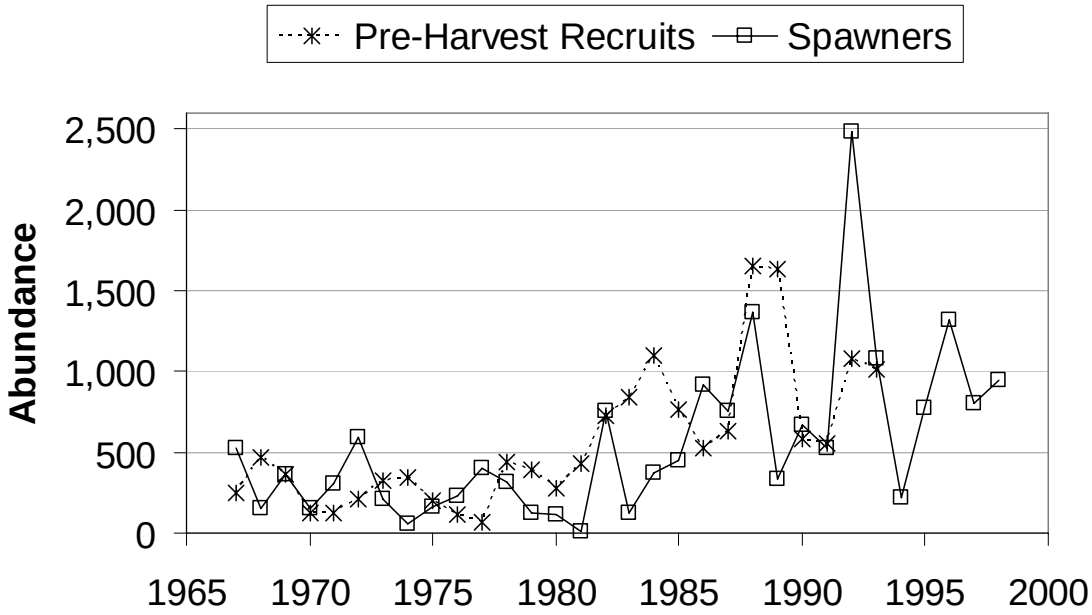


Figure E.2.2.5. Grays River chum salmon recruits and spawners. Based on dataset provided by Rawding (2002; see Appendix E.5.2).

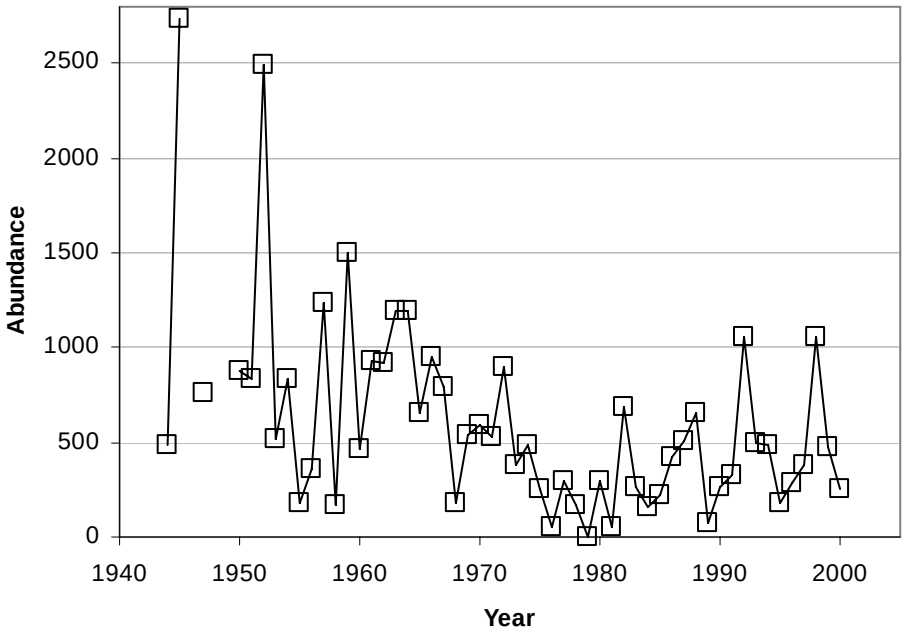


Figure E.2.2.6. Hamilton and Hardy Creek (Lower Gorge population) chum salmon spawner abundance.

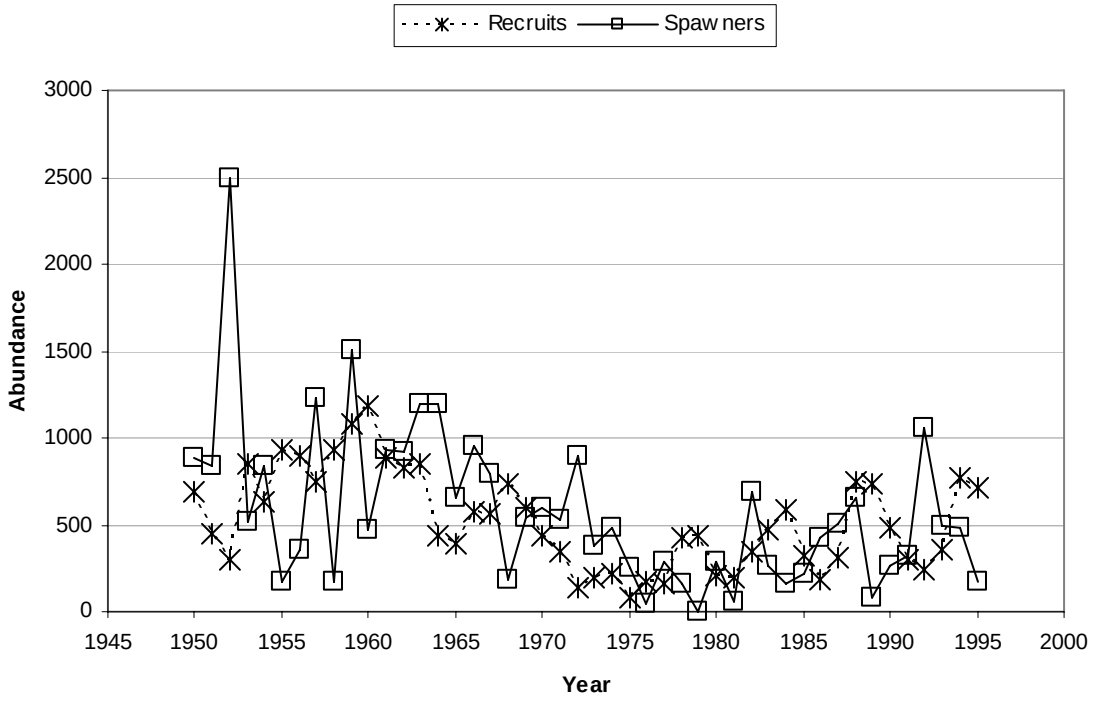


Figure E.2.2.7. Hamilton and Hardy Creek (Lower Gorge population) chum salmon recruits and spawners.

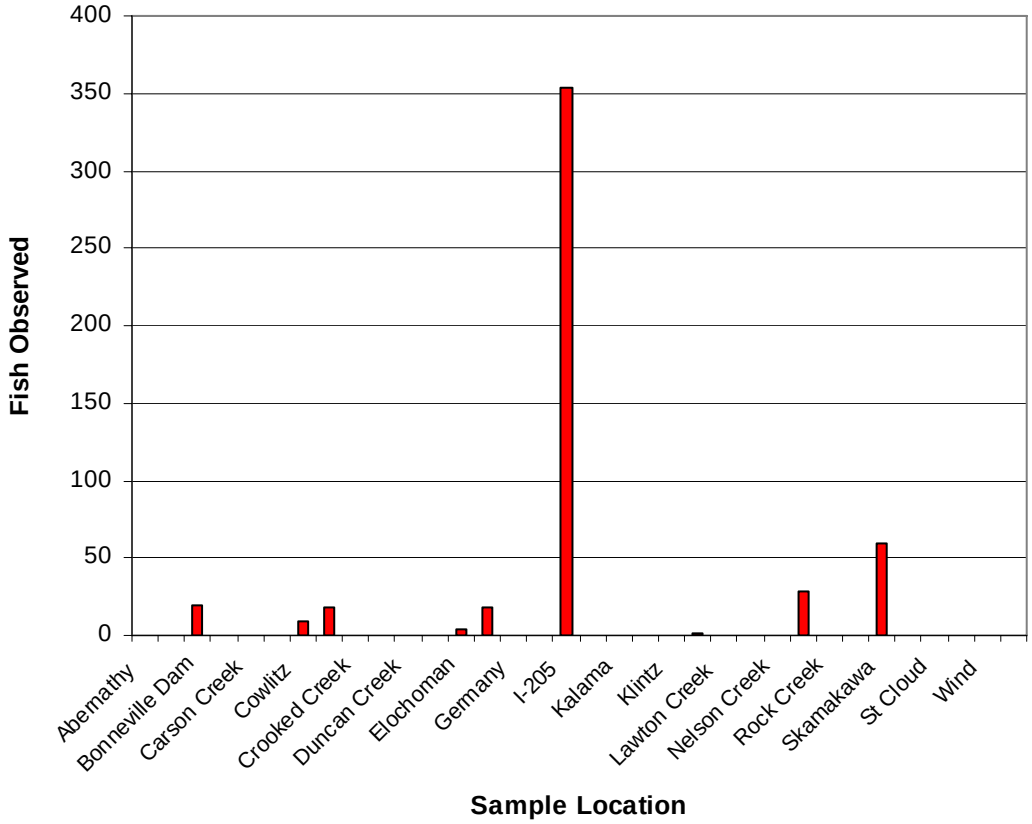


Figure E.2.2.8. Abundance of chum salmon observed in 2000 PSMFC surveys.

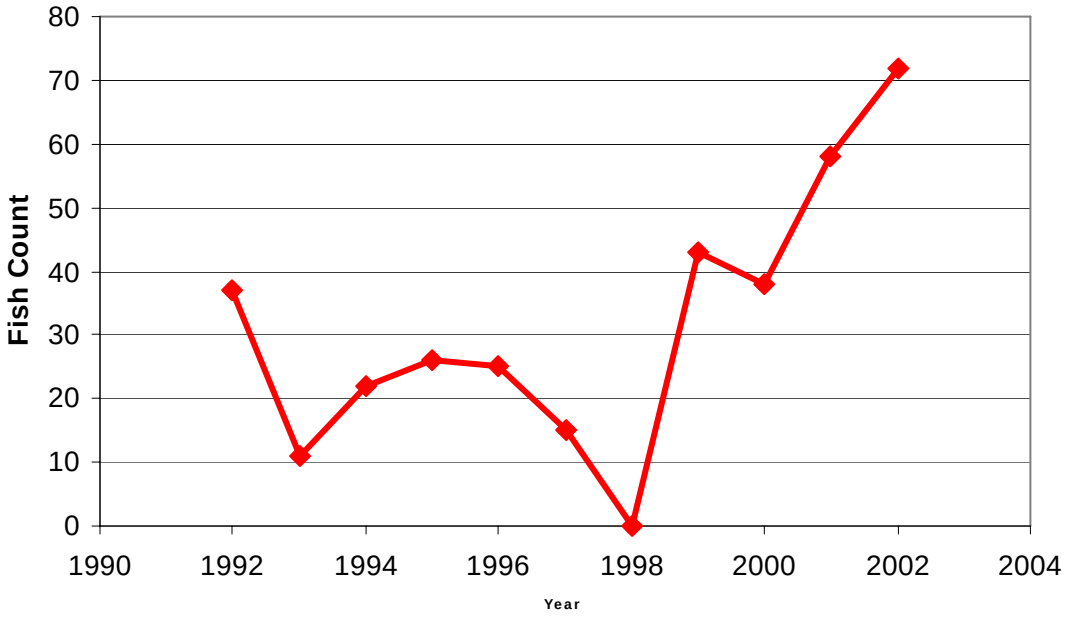


Figure E.2.2.9. Adult chum salmon passing Bonneville Dam.

# E.3 CHUM SALMON BRT CONCLUSIONS

## Hood Canal summer-run chum salmon ESU

Most of the BRT votes for this ESU fell in the "likely to become endangered" category (74%), with a minority in the "danger of extinction" category (32%) and the balance in the "not likely to become endangered" category (Table E.3.1). Mean risk matrix scores were moderately high (3.4-3.7) for each VSP element (Table E.3.2), reflecting ongoing BRT concerns for the major risks identified in previous assessments. An estimated 7 of 16 historical populations in this ESU have been extirpated, with most of the population losses occurring on the eastern side of Hood Canal. Although many of the remaining populations remain at very depressed levels, adult returns in a number of streams increased in 2000-2002. Harvest rates have been reduced considerably since their peaks in the 1980s, which should help facilitate recovery if other limiting factors are addressed. The BRT felt that the joint state/tribal Summer Chum Salmon Conservation Initiative represented a positive step toward recovery of this ESU. However, although the Initiative includes guidelines for habitat restoration, implementation of habitat actions is largely outside its jurisdiction. In particular, the BRT remains concerned that widespread loss of estuary and lower floodplain habitat is an ongoing risk factor for this ESU. A number of supplementation programs have been initiated in recent years to help boost abundance of local populations. Although these programs may help speed recovery of existing populations and/or reseed vacant habitat, the BRT found it difficult to assess the current effects of these programs because of the inability to distinguish most hatchery and wild fish. More intensive marking programs have been implemented recently, and this should make it easier to monitor natural production of summer chum salmon in the future.

## Lower Columbia River chum salmon ESU

Nearly all of the likelihood votes for this ESU fell in the "likely to become endangered" (63%) or "danger of extinction" (34%) categories (Table E.3.1). The BRT had substantial concerns about every VSP element, as indicated by mean risk matrix scores that ranged from 3.5 for growth rate/productivity to 4.4 for spatial structure (Table E.3.2). Most or all of the risk factors identified previously by the BRT remain important concerns. The WLC TRT has estimated that close to 90% of the historical populations in the ESU are extinct or nearly so, resulting in loss of much diversity and connectivity between populations. The populations that remain are small, and overall abundance for the ESU is low. This ESU has showed low productivity for many decades, even though the remaining populations are at low abundance and density dependent compensation might be expected. The BRT was encouraged that unofficial reports for 2002 suggest a large increase in abundance in some (perhaps many) locations. Whether this large increase is due to any recent management actions or simply reflects unusually good conditions in the marine environment is not known at this time, but the result is encouraging, particularly if it were to be sustained for a number of years.

Table E.3.1. Tally of FEMAT vote distribution regarding the status of 2 chum salmon ESUs reviewed by the chum salmon BRT. Each of 13 BRT members allocated 10 points among the three status categories.

| ESU | Danger of Extinction | Likely to Become Endangered | Not Likely to Become Endangered |
|---|---|---|---|
| Hood Canal summer-run | 25 | 89 | 6 |
| Lower Columbia River | 44 | 82 | 4 |

Table E.3.2. Summary of risk scores (1 = low to 5 = high) for four VSP categories (see section "Factors Considered in Status Assessments" for a description of the risk categories) for the 2 chum salmon ESUs reviewed. Data presented are means (range).

| ESU | Abundance | Growth Rate/Productivity | Spatial Structure and Connectivity | Diversity |
|---|---|---|---|---|
| Hood Canal summer-run | 3.7 (3-4) | 3.4 (2-4) | 3.7 (3-5) | 3.5 (2-4) |
| Lower Columbia River | 3.6 (3-4) | 3.5 (2-4) | 4.4 (4-5) | 3.8 (3-5) |

# E.4 REFERENCES


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# E.5 APPENDICES

Appendix E.5.1. Preliminary SSHAG (2003) categorizations of hatchery populations of chum salmon of the two ESUs reviewed. See "Artificial Propagation" in General Introduction for explanation of the categories.

| ESU | Stock | Run | Basin | SSHAG Category |
|---|---|---|---|---|
| Hood Canal summer | Big Quilcene | summer | Quilcene | 1a |
| | Lilliwaup Creek | summer | S. Hood Canal | 1a |
| | Hamma Hamma | summer | S. Hood Canal | 1a |
| | Big Beef Creek | summer | N. Hood Canal | 1b |
| | Salmon Creek | summer | Dungeness | 1a |
| | Chimacum Creek | summer | Dungeness | 1b |
| | Union River | summer | Union | 1a |
| | Jimmycomelately | summer | Dungeness | 1a |
| Lower Columbia River | Sea Resources | fall | Chinook River | 1a |
| | Gorley Creek | fall | Grays | 1a |
| | Hamilton Creek | fall | Gorge | 1a |
| | Washougal/Duncon Creek | fall | Washougal | 1a |

Appendix A.5.2. Chum Salmon Time Series Data Sources

**Hood Canal Chum Salmon ESU**

| | |
|---|---|
| Population | Anderson |
| Years of Data, Length of Series | 1970-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio). Counts include all ages |
| Hatchery Reference | |
| Hatchery Notes | No supplemental hatchery program |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The offshore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Anderson is that from the areas 12B, 12, and 9A. |
| Age Reference | Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | Spawner survey; n=10 fish sampled from 2001-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Big Beef |
| Years of Data, Length of Series | 1968-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap. Includes all ages. |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, personal communication (Johnson 2003b) |
| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio). Counts include all ages |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | Supplementation program was started with releases in basin in 1996. No sampling for hatchery marks on escapement grounds, but assume that all returns after 1996 are from hatchery plants since there have been no returns for several years prior. |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The off shore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Big Beef is that from the areas 12B, 12, and 9A. |
| Age Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, unpublished 2001 and 2002 |

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| | age data, personal communication (Johnson 2003a,b) |
| Age Notes | Trap, spawner survey; n=396 fish sampled from 200-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Big Quilcene |
| Years of Data, Length of Series | 1968-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio) Method - area under the curve, 10 day stream life. Escapement counts include all ages. |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | Supplementation program started in 1992 in the Big Quilcene River. Broodstock is taken from returning fish; eggs are incubated, and fry released into the Big Quilcene. |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The off shore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Big Quilcene is that from areas 82F, 12A, 12B, 12, and 9A. |

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| Age Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | From bay fisheries, spawner surveys; n=3770 fish sampled from 1992-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Chimacum |
| Years of Data, Length of Series | 1999-2002 |
| Abundance Type | ? |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, personal communication (Johnson 2003b) |
| Abundance Notes | Returns come from recent hatchery plants to system. Escapement counts include all ages |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | Reintroduction program started in 1996 when eyed eggs were transferred in from Salmon Creek. |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The off shore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to |

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| | spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. There is no terminal catch area for Chimacum. |
| Age Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | Trap, spawner survey; n=537 fish sampled from 1999-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Combined Quilcene |
| Years of Data, Length of Series | 1974-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio). Escapement counts include all ages. |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | CWT Otolith sampling for hatchery marks |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables |

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| | (Nick Lampkis 2003) |
| Harvest Notes | The off shore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Quilcene is that from areas 82F, 12A, 12B, 12, and 9A |
| Age Reference | implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | From bay fisheries, trap, spawner surveys; n=4076 fish sampled from 1992-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Dewatto |
| Years of Data, Length of Series | 1968-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio). Escapement counts include all ages |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | No broodstock take |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point |

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| | Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The off shore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Dewatto is that from the areas 12C, 12B, 12, and 9A |
| Age Reference | Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | Spawner survey; n=5 fish sampled from 2001-2001. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Dosewallips |
| Years of Data, Length of Series | 1972-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio). Escapement counts include all ages |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | There are no hatchery releases in basin. There may be some from nearby hatchery summer chum releases, but it is not sampled. Hatchery impact on natural spawners assumed to be zero. |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point |

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| | Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The off shore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Dosewallips is that from the areas 12B, 12, and 9A |
| Age Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | Trap, spawner survey; n=500 fish sampled from 1999-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Duckabush |
| Years of Data, Length of Series | 1968-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio). Escapement counts include all ages |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | No hatchery releases or broodstock take in the Duckabush |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer |

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| | chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The off shore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Duckabush is that from fishing areas 12B, 12, 9A. |
| Age Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | Trap, spawner survey; n=326 fish sampled from 1999-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Hamma Hamma |
| Years of Data, Length of Series | 1968-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio). Escapement counts include all ages |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | Supplementation program was started with broodstock takes in 1998; assumed that there was no |

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| | hatchery straying into basin prior to hatchery releases in basin. |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The offshore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Hamma Hamma is that from the areas 12B, 12, 9A |
| Age Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | Trap, seine, spawner survey; n=386 fish sampled from 1999-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Jimmycomelately |
| Years of Data, Length of Series | 1974-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, personal communication (Johnson 2003b) |
| Abundance Notes | Escapement counts include all ages |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region |

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| | (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | Supplementation program started with 1999 broodyear |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The offshore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Jimmycomelately is that from the Sequim area. |
| Age Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | Trap, spawner survey; n=233 fish sampled from 1999-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Lilliwaup |
| Years of Data, Length of Series | 1971-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio). Escapement counts include all ages |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for |

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| | the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | Supplementation program was started with broodstock take in 1992 |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The offshore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Lilliwaup is that from the areas 12C, 12B, 12, and 9A |
| Age Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | Trap, spawner survey; n=233 fish sampled from 1999-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Little Quilcene |
| Years of Data, Length of Series | 1968-2002 |
| Abundance Type | Method - area under the curve, 10 day stream life. |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio). Escapement counts include all ages. |

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| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | Supplementation program started in 1992 in the Big Quilcene River. Broodstock is taken from Big Quilcene and fry released into the Big Quilcene. Some return to Little Quilcene. |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The off shore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Little Quilcene is that from the areas 12A, 12B, 12, and 9A. |
| Age Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | From bay fisheries, spawner survey, seine in bay, rack; n=2599 fish sampled from 1992-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Salmon |
| Years of Data, Length of Series | 1971-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, personal |

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| | communication (Johnson 2003b) |
| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio). Escapement counts include all ages |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | Supplementation program was started in 1992 |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The off shore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Salmon is that from the Discovery Bay. |
| Age Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | Trap, spawner survey; n=1087 fish sampled from 1999-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Salmon/Snow |
| Years of Data, Length of Series | 1974-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan |

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| | de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio). Escapement counts include all ages |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The off shore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Salmon and Snow is that from Discovery Bay. |
| Age Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | Trap, spawner survey; n=1227 fish sampled from 1999-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Snow |
| Years of Data, Length of Series | 1972-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. |

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| | 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, personal communication (Johnson 2003) |
| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio). Escapement counts include all ages |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | No estimate of hatchery fish contribution to spawners |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The off shore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Salmon and Snow is that from Discovery Bay. |
| Age Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | Trap, spawner survey; n=140 fish sampled from 1999-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

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|---|---|
| Population | Tahuya |
| Years of Data, Length of Series | 1972-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point |

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| | Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, personal communication (Johnson 2003b) |
| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio). Escapement counts include all ages |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | No estimate of hatchery contribution to spawners |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The off shore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Tahuya is that from the areas 12D, 12C, 12B, 12, and 9A. |
| Age Reference | |
| Age Notes | No surveys |

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| Population | Union |
| Years of Data, Length of Series | 1974-2002 |
| Abundance Type | Trap count (excluding broodstock take adjustment) plus redd counts downstream of trap |
| Abundance References | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |

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| Abundance Notes | Redd count expanded by 2 (assumes 1:1 male female ratio). Escapement counts include all ages |
| Hatchery Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001) |
| Hatchery Notes | Supplementation program was started with broodstock take in 2000 |
| Harvest Reference | Summer Chum Salmon Conservation Initiative: An implementation plan to recover summer chum salmon in the Hood Canal and Strait of Juan de Fuca Region (WDFW & Point No Point Treaty Tribes 2000); Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Run Reconstruction Tables (Nick Lampkis 2003) |
| Harvest Notes | The offshore catch includes marine catch from Seattle Area 10, Admiralty Area 9, U.S. Conv. Areas and Canadian Area 20. For summer chum these are assumed to be mature fish returning to spawning grounds. Catches by population/stock are determined from the run reconstruction tables given in the Summer Chum Salmon Conservation Initiative report. The terminal catch for Union is that from the Sequim area. |
| Age Reference | Summer Chum Salmon Conservation Initiative. Supplemental Report No. 3 Annual report for the 2000 summer chum salmon return to the Hood Canal and Strait of Juan de Fuca Region (WDFW and Point No Point Treaty Tribes 2001); Thom Johnson, unpublished 2001 and 2002 age data, personal communication (Johnson 2003a,b) |
| Age Notes | Trap, spawner survey; n=317 fish sampled from 1999-2002. Age distribution reconstructed for other years using average cohort distribution weighted by annual abundance of contributing years (Norma Sands) |

**Columbia River Chum Salmon ESU**

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|---|---|
| Population | Grays River Chum Salmon |
| Years of Data, Length of Series | 1945 - 2000, 34 years |
| Abundance Type | Live/dead index |
| Abundance References | Hymer, Joe. 2000; Keller, Ken. 2001; Keller, Ken and Richard Bruce. 2001 |
| Abundance Notes | 1999 and 2000 data downloaded from Streamnet; references are Keller and Keller and Bruce |
| Hatchery Reference | Rawding, Dan (WDFW). 2001c. |

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| Hatchery Notes | There has been no significant contribution of hatchery fish to the Grays River chum salmon population |
| Harvest Reference | Rawding, Dan (WDFW). 2001c. |
| Harvest Notes | There has been no significant directed harvest on Columbia chum salmon for the duration of the time series. Indirect harvest is believed to be negligible |
| Age Reference | Salo, E. O. 1991. |
| Age Notes | LCR_Wil Chinook Chum Steelhead from Holmes and McClure |
| Population | Grays River Chum Salmon |
| Years of Data, Length of Series | 1967 - 1998, 34 years |
| Abundance Type | Live/dead index |
| Abundance References | Rawding. 2001 |
| Abundance Notes | |
| Hatchery Reference | Rawding, Dan (WDFW). 2001c. |
| Hatchery Notes | There has been no significant contribution of hatchery fish to the Grays River chum salmon population |
| Harvest Reference | Rawding, Dan (WDFW). 2001c. |
| Harvest Notes | There has been no significant directed harvest on Columbia chum salmon for the duration of the time series. Indirect harvest is believed to be negligible |
| Age Reference | Salo, E. O. 1991. |
| Age Notes | LCR_Wil Chinook Chum Steelhead from Holmes and McClure |
| Population | Lower Gorge Tributary Chum Salmon (Hamilton Cr, Hamilton Sp. & Hardy Cr Chum) |
| Years of Data, Length of Series | 1944 - 2000, 57 years |
| Abundance Type | Live/dead index |
| Abundance References | Rawding, Dan (WDFW). 2001c. |
| Abundance Notes | Rawding provided separate time series for each subpopulation that were combined for analysis |
| Hatchery Reference | Rawding, Dan (WDFW). 2001c. |
| Hatchery Notes | There has been no (or extremely little) hatchery impact on Hardy Creek chum salmon. |
| Harvest Reference | Rawding, Dan (WDFW). 2001c. |
| Harvest Notes | There has been no significant directed harvest on Columbia chum salmon for the duration of the |

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| | time series. Indirect harvest is believed to be negligible |
| Age Reference | Salo, E. O. 1991. |
| Age Notes | LCR_Wil Chinook Chum Steelhead from Holmes and McClure |